THE PLESSEY COMPANY LIMITED
PLESSEY AVIONICS & COMMUNICATIONS

SERVICE MANUAL

FOR

HF RADIO TYPE RT320

VOLUME 1

First and Second Line Servicing

Publication No. 640/HA/09560

PLESSEY AVIONICS & COMMUNICATIONS
VICARAGE LANE · ILFORD · ESSEX · ENGLAND
TELEPHONE 01-478-3040 TELEX 897971

Prepared By:-

PLESSEY AVIONICS & COMMUNICATIONS

MARTIN ROAD · WEST LEIGH · HAVANT · HAMPSHIRE

TELEPHONE HAVANT (0705) 48 6391 TELEX 86227

© 1981 THE PLESSEY COMPANY LIMITED

The information contained herein is the property of The Plessey Company Limited and may not be copied, used or disclosed in whole or in part except with the prior written permission of The Plessey Company Limited or, if it has been furnished under a contract with another party, as expressed authorised under that contract. The copyright and the foregoing restrictions on copying, use and disclosure extend to all the media in which this information may be preserved, including magnetic storage, punched card, paper tape, computer print-out, visual display, etc.

No liability is accepted for any errors or omissions.

AMENDMENT RECORD SHEET

To record the incorporation of an amendment list in this publication, sign against the appropriate A.L. No. and insert the date of incorporation.

A.L. No.	AMENDED BY	DATE	A.L. No.	AMENDED BY	DATE

SERVICE MANUAL

FOR

HF RADIO TYPE RT320

HEALTH HAZARDS

THE RF POWER TRANSISTORS USED IN UNIT 2a OF THE RECEIVER/TRANSMITTER CONTAIN BERYLLIUM OXIDE MATERIAL WHICH, IF NOT PROPERLY HANDLED, CAN CONSTITUTE A SERIOUS HAZARD TO HEALTH.

UNDER NO CIRCUMSTANCES SHOULD THESE TRANSISTORS BE DELIBERATELY EXPOSED TO FIRE, BROKEN OPEN OR ABRADED.

SCRAP TRANSISTORS MUST BE PLACED IN A CONTAINER WHICH IS CLEARLY LABELLED "DANGER BERYLLIUM OXIDE MATERIAL IN THIS CONTAINER". SUBSEQUENT ACTION MUST BE IN ACCORDANCE WITH THE APPROPRIATE NATIONAL REGULATIONS FOR DISPOSAL OF HAZARDOUS TOXIC MATERIALS.

WARNING:

1. WHEN BERYLLIUM OXIDE IS EXPOSED TO FIRE IT RELEASES LARGE QUANTITIES OF TOXIC FUMES.

2. DUST FROM BERYLLIUM OXIDE PRESENTS A SERIOUS TOXIC HAZARD.

SERVICE MANUAL

FOR

HF RADIO TYPE RT320

PREFACE

The information given in this manual relates to servicing the unit at three separate lines of servicing and is sub-divided accordingly. The facilities provided at these lines of servicing are assumed to be as follows:-

1st line
1. Check out of a complete unit.
2. Simple repair such as replacing a fuse, lamp etc.

2nd line
1. Repair of a unit returned from the 1st line facility by replacement of a faulty module (or certain discrete components).
2. Testing of a complete unit to ensure that it is serviceable on return to the 1st line facility.

3rd line
1. Repair of unit or module returned from the 2nd line facility.
2. Comprehensive testing of module or unit before it is returned to the 2nd line facility as serviceable.

The information given in the part for 1st line servicing is complete in itself. The information in the part for 2nd line servicing is additional to that given for 1st line. Similarly the information in the parts for 3rd line is additional to that given in the other sections.

SERVICE MANUAL

FOR

HF RADIO TYPE RT320

CONTENTS

PART	TITLE
1	First line servicing
2	Second line servicing
3	Third line servicing
4	Testing at third line

NOTE: Parts 1 and 2 of this manual are located in Volume 1, part 3 is located in Volume 2, and part 4 is located in Volume 3.

SCEOND LINE SERVICING

OF

RECEIVER-TRANSMITTER RT320

CONTENTS

	Para.
TECHNICAL DESCRIPTION	
General	1
Tx/Rx switching	5
Transmission	
Audio signal path	11
AF to IF modulation	16
IF signal path	19
IF to RF modulation	22
RF power amplification	26
Monitor meter	29
Antenna circuits	31
Reception	
RF signal path	37
IF signal path	40
Demodulation	41
AF signal path	44
Loss of phase lock	45
Frequency check	46
Tuning	49
Power supplies	59
TEST PROCEDURES	62
ASSEMBLY/DISASSEMBLY	63
REPAIR	
General	64
Repainting	68
COMPONENTS LIST	79

ILLUSTRATIONS

Fig.		Page
1	Transmission Section - functional block and interconnections ...	15
2	Reception Section - functional block and interconnections ...	19
3	Frequency Synthesiser - functional block and interconnections ...	23
4	Power Supplies - functional block and interconnections	25
5	Receiver Transmitter - breakdown	27

TECHNICAL DESCRIPTION

NOTE: The description should be read in conjunction with Figures 1, 2, 3 and 4. These diagrams contain sufficient information to enable them to be used as high level circuit diagrams. However, information relating to internal circuit detail (pin numbers, circuit references etc) of modules is included to enable the diagrams to be utilised at third line; this extra information should be ignored at second line.

GENERAL

1. The unit consists of three main assemblies:

(1) Front panel and chassis assembly (Unit 1).

(2) Rear panel assembly (Unit 2).

(3) Case (Unit 7).

secured together by bolts and sealed by gaskets.

2. In addition to a number of discrete components, the front panel and chassis assembly mounts a number of assemblies termed Units 3 to 6 and 8, 9 respectively.

3. Closely related assemblies and sub-assemblies of the various units are identified by a letter suffix, for example Units 2a and 2b are sub-assemblies of Unit 2, Units 6a and 6b are separate units closely associated with Unit 6.

4. The foregoing identities are used in Figures 1 to 4, and the locations of these items are given in figure 5.

NOTE: All circuit references given in this text are prefixed by the unit reference. For example 2SK5 refers to socket 5 in Unit 2.

TX/RX SWITCHING

5. The receiver is switched off, and the transmitter is switched on only while the pressel (or key) is depressed. On CW modes only, a delay circuit prevents the radio returning to the receive condition when the key is released for the transmission of spaces.

6. Switching is by relay contacts which transfer circuit and power supply connections from the receiver to the transmitter (and vice versa). The relay coils are operated by circuits associated with the pressel (or key).

7. When the pressel (or key) is depressed, OV is connected via pin F of either 2SK5 or 2SK6 to an inverter circuit in unit 6d. The inverter output operates various gates in the transmitter audio circuits (see para.13) and operates a relay driver circuit which causes relays to energise and their contacts to change over from the receive condition to the transmit condition thus:

(1) Relay 2bRLA/2

(a) Contact 2bRLA/1 connects +24V to RF Power amplifiers in Unit 2a and operates relays 3aRL1/2 and 6RLA/2. A transistor circuit in Unit 1a is operated by the same signal as relay 2bRLA/2. This circuit operates more rapidly than the relay, and thereby protects contact 2bRLA/1 by taking the initial current surge.

(b) Contact 2bRLA/2 transfers the antenna circuit connections from the receiver to the transmitters.

(2) Relay 3aRL1/2 contacts transfer a controlled tuned circuit from the receiver path to the transmit path.

(3) 6RLA/2

(a) Contact 6RLA/1 transfers the band pass filter connection from receive path to transmit path.

(b) Contact 6RLA/2 transfers the +6V supply from the +6V Rx rail to the +6V Tx rail.

8. When the pressel (or key) is released, the relays release and the circuits revert to the receive condition.

9. In the CW mode of operation, OV is connected by the mode switch 1S1 to the relay drive delay circuits. This provides a delay between release of key (or pressel) and release of relays to allow spaces to be formed by the transmitter circuits. The circuits do not introduce a significant delay between operating the key and energising of relays.

10. In the FREQ CHECK position of the mode switch 1S1, +6V Rx is applied to pin 13 of Unit 6d; this inhibits the action of the pressel switch (refer to para.48).

TRANSMISSION

NOTE: Circuits which are unique to the transmitter will function only when the pressel is depressed (see para.5).

Audio signal path

11. Speech from a microphone is applied to the radio at either of sockets 2SK5 or 2SK6 and is routed via decoupling circuits in Unit 2g to AF Amplifier and VOGAD circuit in Unit 6c. This provides a speech signal for the main signal path and a similar signal for the sidetone path.

12. A 2 kHz square wave generated within the synthesiser is routed via a filter (Unit 1a) which provides a 2 kHz sinusoidal tone signal, which is fed to the main path, and the sidetone path.

13. Two gates select which of the two audio signals, speech or 2 kHz tone, is to pass to the main and sidetone paths. The sidetone gate operates only when the pressel (or key) is pressed; both gates are controlled by 6V signals to provide:

(1) 2 kHz tone to both paths if either:

(a) +6V Tx CW is connected to the gates (CW(W) and CW(N) positions of mode switch 1S1).

(b) +6V Tx ANT is connected to the gates (ANT position of power switch 1S2).

(2) Speech to both paths in default of the above (AM, and SSB positions of mode switch 1S1 when power switch is not set to ANT).

NOTE: There is a symmetrical limiting stage on the Tx AF gate integrated circuit. By varying the gain available before this stage, the peak to mean ratio of the AF waveform can be controlled.

14. The AF signal on the sidetone path is routed to the earphones via the receiver audio amplifier (fig.2 sheet 2).

15. The AF signal on the main signal path is routed to the 1st transmitter modulator in Unit 6d.

NOTE: On CW mode, the AF signal will be a 2 kHz tone, keyed on sidetone path, continuous on main signal path.

AF to IF modulation

16. Inputs to the 1st transmitter modulator (Unit 6d) are AF from Unit 6c and a 1.75 MHz carrier wave from a reference oscillator (Unit 8).

17. The modulator produces a complex waveform of the sum and difference of the two input signals. Both original input signals are effectively suppressed. Thus, the components in the IF output are 1.75 MHz + AF and 1.75 MHz - AF; these comprise the upper and lower IF sidebands.

18. On AM mode only, the 1.75 MHz carrier is reinserted before the crystal filters.

IF signal path

19. IF from the modulator is applied to a clipper and switched gain amplifier (Unit 6d) which ensures that the peak-to-peak amplitude of the signal applied to the PA is the same on all modes.

20. The IF signal is produced only when the pressel (or key) is depressed. Clipping occurs on ALL modes.

21. The IF signal is routed via a selected one of three crystal filters; selection is by the front-panel mode control switch 1S1. Action is as follows:

(1) AM Mode. The input of 1.75MHz $\pm$ AF is fed via a band pass filter covering 1.75 MHz $\pm$ 3.125 kHz. The output is an amplitude-modulated 1.75MHz signal.

(2) SSB and CW(W)Modes. The inputs of 1.75 MHz + AF and 1.75 MHz - AF are fed via a band-pass filter covering 1.7485MHz $\pm$ 1.95kHz. Note that in the case of CW(W), AF is a 2kHz sine-wave. The output is a lower side band signal of 1.75MHz-AF; in the case of CW(W) this is a morse keyed 1.748MHz signal, and in the case of SSB it is a speech sideband approximately 4kHz wide and centred on 1.748MHz.

(3) CW(N)Mode. The inputs of 1.75MHz + AF and 1.75MHz-AF are fed via a band pass filter covering 1.748MHz $\pm$ 200Hz. The output is a single (lower) sideband signal of 1.75MHz-AF, i.e. a morse keyed 1.748MHz signal inside a bandwidth of 400Hz.

IF to RF modulation.

22. IF from the selected filter is routed via a buffer amplifier to the 2nd transmitter modulator (Unit 6e). The second input to this modulator is supplied by the VFO (Unit 3h). The output frequency of the VFO is controlled by the front panel frequency controls; it is (calling the panel set frequency 'fo') fo + 1.75MHz in AM mode and fo + 1.748 MHz in all other modes.

23. The modulator is similar to the first modulator, and produces a complex waveform of the sum and difference of the two input frequencies. Both original input signals are effectively suppressed.

24. The input from the first modulator varies in type with the selected mode of operation, being either an amplitude modulated 1.75MHz carrier (AM mode) or the lower sideband of a 1.75MHz carrier (all other modes). The difference frequency output from the 2nd transmitter modulator is selected in Unit 3a, and is as follows:-

(1) AM Mode. An amplitued-modulated carrier at fo, i.e.
[(fo+1.75) - (1.75 $\pm$ AF)] = fo $\pm$ AF

(2) CW(W) and CW(N) modes. A morse keyed constant-amplitude signal at fo, i.e.
[(fo + 1.748) - (1.75-2)] = fo

(3) SSB mode. A USB speech signal occupying 3.9kHz bandwidth centred on fo, i.e.
[(fo + 1.748) - (1.75-AF)] = fo - 2kHz + AF

Note that in all cases the transmission is centred on fo; i.e. the frequency of transmission is, irrespective of mode, always that set on the front panel controls.

25. The modulator output is routed via a buffer amplifier to a controlled tuned circuit in Unit 3a. This circuit is tuned to the difference frequencies from the modulator; its bandwidth varies from 50kHz at 2 MHz to 750 kHz at 30 MHz and it therefore rejects the modulator sum frequencies. The circuit is tuned by varactor diodes controlled by a d.c. voltage from Unit 9 which sets the centre of the response curve at the indicated frequency, fi.

RF power amplification

26. The modulator difference frequencies passed by the varible tuned circuit (Unit 3a) are routed via a controlled RF amplifier and power amplifiers in Unit 2a. The harmonic content of the resulting output is reduced by one of six low pass filters (Units 2c to 2f), as selected by the FREQUENCY RANGE switch. The filter output is routed to the antenna (para.31) via monitor circuits in Unit 2b.

27. An automatic level control (ALC) circuit adjusts the gain of the first RF amplifier to maintain the output power to suit conditions of load VSWR, battery voltage, operating mode and demanded power level. The ALC circuit normally responds to the ALC monitor which is developed from the RF output by a circuit in Unit 2b. A second control voltage, overload monitor, provides protection against overload; this voltage is produced by a monitor circuit in both Unit 2a and Unit 2b; when an overload condition is sensed, either excessive current drain or excessive voltage (i.e. short circuit or open circuit output), this control voltage reaches a level that exceeds the normal ALC and reduces the RF gain to a safe level.

28. The ALC system provides time constants, necessary to give suitable control of peak envelope power (PEP) without introducing excessive intermodulation distortion. A delayed action mean control limits the power output under single tone conditions (e.g. CW mode) to approximately 4 db below PEP. The PEP when the power switch 1S2 is set to HP or BATT CHK is 30W nominal, the PEP is reduced by 10 db nominal when the power switch is set to LP or ANT.

Monitor meter

29. A small meter on the front panel, in conjunction with various monitor circuits and the power switch, provides visual indication of battery level, antenna current and VSWR.

30. Monitor circuit output signals are selected by the power switch 1S2. The selected signal being taken to the meter via a circuit in Unit 6 which protects the meter against excessive voltage on the signal line. The meter display for each setting of 1S2 is:

(1) ANT — The meter input is a voltage derived from the transmitter RF by reflectometer Unit 2b. This voltage is a maximum when the transmitter is working into a 50 ohm load. Thus the meter gives indication of antenna tuning.

(2) HP and LP — The meter input is a voltage proportional to the antenna current.

(3) BATT CHK — A voltage derived from the 24V rail is supplied to the meter.

NOTE: The transmitter operates on HP when the power switch is set to BATT CHK. Since the current drain is greater on transmit than on receive, the check is best carried out on a CW mode with the pressel depressed.

ANTENNA CIRCUITS (see fig.1 or fig.2)

31. Relay contact 2RLA/2 (Unit 2b) connects either the transmitter or the receiver, as appropriate, to the antenna circuits.

32. If a 50 ohm centre fed antenna is used, the connection is taken directly to the antenna via socket 2SK7 on the rear panel of the radio. This socket is also used for connection to an antenna via external equipment (such as a power amplifier unit).

33. For an antenna other than centre fed dipole, the connection is taken via socket 2SK7, an external link, socket 2SK8, a VHF filter (Unit 2h) and the antenna tuning unit (Unit 4). The antenna being connected to the antenna tuning unit at one of the connectors provided on the side of the radio.

34. The VHF filter reduces the level of broadband noise and spurious outputs in the frequency range 33 MHz to 75 MHz, by at least 25 dB.

35. The antenna tuning unit contains circuits which are adjusted by the front panel controls, LOAD, RANGE and TUNE, to effect matching of the antenna impedance to 50 ohms at the frequency of operation.

36. To set the antenna tuning, the power switch is set to ANT. The pressel is depressed and a 2 kHz tone is injected into the Tx audio paths (para.13), the transmitter power level is set low (para.28) and an appropriate monitor voltage is routed to the meter (para.30). The antenna tuning unit controls are adjusted to obtain a maximum reading on the meter. (A label on the radio case provides recommended initial control settings for the selected operating frequency and antenna).

RECEPTION (see Fig. 2)

NOTE: Circuits which are unique to the receiver will function only when the transmitter is switched off (see para.5).

RF signal path

37. RF from the antenna is routed by relay contact 2bRLA/2 to an amplifier in Unit 3a. The amplifier gain is controlled by an agc voltage related to the signal amplitude. The amplifier input and output circuits are tuned by varactor diodes controlled by a d.c. voltage from Unit 9 to maintain the frequency of operation at the centre of the response curve of the tuned circuit.

38. The frequency of the incoming RF signal is:-

(1) AM Mode. fo $\pm$ AF

(2) CW(W) and CW(N) Modes. fo

(3) SSB Mode. fo - 2kHz + AF

39. The amplified RF is applied to a mixer, the second input to which is the VFO output. Note that the VFO frequency is fo + 1.75MHz in AM Mode and fo + 1.748MHz in all other modes. The difference frequency output from the mixer is selected by a bandpass-tuned (1.75MHz) amplifier followed by a selected one of the three filters used for transmission (see para. 21 and para 40).

The difference frequency outputs are:-

(1) AM Mode: 1.75MHz $\pm$ AF for applicatin to an envelope detector, ie.
[(fo + 1.75) - (fo $\pm$ AF)] = 1.75 $\pm$ AF

(2) CW(W) and CW(N) Modes: 1.748MHz, ie.
[(fo + 1.748) - fo] = 1.748

(3) SSB Mode: 1.75MHz - AF, ie.
[(fo + 1.748) - (fo - 2 + AF)] = 1.75 - AF

IF signal path

40. The mixer output is taken to a tuned circuit which rejects the sum frequencies and passes the difference frequencies on to a buffer amplifier. The buffered signal is routed to the IF amplifiers via a crystal bandpass filter selected by the mode switch 1S1 thus:

	Mode	Bandpass(6dB Points)
(1)	AM	1.75MHz $\pm$ 3.125kHz
(2)	SSB and CW(W)	1.7485MHz $\pm$ 1.95KHz
(3)	CW(N)	1.748MHz $\pm$ 200Hz

Demodulation

41. After amplification by the IF amplifiers in Unit 6a, the IF signal is passed to Unit 6b for recovery of the AF intelligence thus:

(1) The IF is applied to a demodulator which consists in effect of a

balanced mixer receiving as its second input a 1.75 MHz signal from a reference oscillator. In CW modes the IF input is 1.748MHz, therefore the difference frequency audio output is 2 kHz. In SSB mode the IF input is 1.75 MHz-AF, the Audio range extending to approximately 4 kHz; mixing this with 1.75 MHz produces a difference frequency output over the approximate range zero to 4 kHz. The audio output from the demodulator is passed to an audio gate and to an agc generator.

(2) For an AM signal, the modulated IF is passed to a diode detector. The detector outputs are AF and d.c. The AF is passed to an audio gate and the d.c. to an agc generator.

42. According to the mode selected, the appropriate agc voltage is taken via the mode switch 1S1 to one of the IF amplifiers and the controlled RF amplifier.

43. If AM mode is selected, +6V Tx AM from switch 1S1A inhibits the 1.75 MHz signal from the reference oscillator, which inhibits the SSB demodulator and causes the AF from the AM detector to be gated to the audio amplifiers. For any other mode, AF from the SSB demodulator is passed to the audio amplifiers.

AF signal path

44. AF from the audio gate, at a level selected by the GAIN control on the radio front panel, is taken to an audio amplifier in Unit 6b. The Tx sidetone is also applied to this amplifier. On CW modes, OV CW from the mode switch 1S1 causes the level of sidetone audio input to the amplifier to be reduced for more comfortable listening. The amplified audio signal is passed through decoupling circuit (Unit 2g) to the earphones connected either to socket 2SK5 or socket 2SK6.

Loss of phase lock

45. Loss of phase lock at the synthesiser (Unit 9) results in the production of a d.c. signal which is routed to Unit 6b and causes:

(1) A 2 kHz tone from Unit 1a to be injected into the audio amplifier input to give audible indication that the radio is "off tune".

(2) The reference oscillator (Unit 8) sine wave output to be inhibited, effectively switching off transmitter and receiver AF - IF modulators.

Frequency check

46. In the FREQ. CHECK position of the mode switch 1S1, the 400Hz bandpass CW(N) crystal filter 1FL3 is connected in the IF signal path. In addition, +6V Rx FREQ is provided by the mode switch to gate the 2 kHz tone to the audio circuits and to inhibit the action of the pressel switch (para.10).

47. When the front panel frequency switches are set exactly to the frequency of a known CW transmitter, reception of that transmission will produce a 2kHz audio signal which will beat with the internallly generated 2KHz tone. The operator hears this beat output, and can judge the frequency accuracy of his equipment from the beat frequency.

48. If the radio is in the transmit condition when the mode switch is set to FREQ. CHECK, the +6V Rx FREQ signal will not be produced until the pressel is released. Under certain test bench conditions, the pressel is replaced by a toggle switch and the radio is locked in the transmit condition. Damage to a signal generator will occur if it is connected to the antenna socket while the transmitter is switched on. Accordingly, +6V Tx FREQ is provided by the mode switch to inhibit the reference oscillator sine wave output, thereby inhibiting the transmitter, until the radio is switched to the receive condition.

TUNING (see fig.3)

49. The wide range of operating frequencies is provided by a frequency synthesiser (Unit 9) operating in conjunction with a VFO (Unit 3h) and a reference oscillator (Unit 8) connected to form a phase and frequency locked loop which controls the selected operating frequency with an accuracy of one part per million.

NOTE: For completeness, fig.3 gives a level of detail similar to that of figs.1 and 2. However, this should not be taken as implying that a faulty Unit 9 can be repaired at second line by replacement of one or other of its sub-assemblies (Units 9a to 9f).

50. The reference oscillator provides a 1.75 MHz square wave which is derived from the output of a 3.5 MHz crystal controlled oscillator. This square wave is applied to Unit 9 where it operates a divider chain that provides the 2 kHz signal used in the radio and a 250 Hz reference signal for use within Unit 9.

51. The VFO output is fully variable over the frequency range selected by the front panel FREQUENCY RANGE switch. Tuning of the VFO is by varactor diodes which are controlled by a voltage provided by the synthesiser (this voltage also controls the controlled tuned circuits in Unit 3a). An output is taken from the VFO to Unit 9 where it operates a variable frequency divider. The overall division factor is set by the six decade switches on the front panel and the counter output is 250 Hz when the VFO is operating at, according to mode, either 1.748MHz or 1.75 MHz above the frequency indicated by these six switches. The VFO is only required to operate at 1.75 MHz above the set frequency when the equipment is in AM mode. In all other modes the VFO is required to operate at 1.748 MHz above the set frequency, and this is achieved by what is known as 'sidestep' control. A control voltage input (COMMAND SIDESTEP) from the front panel MODE switch changes the division ratio of the variable frequency divider in all modes except AM, the alteration being equivalent to a 2KHz drop in frequency of the controlled VFO without alteration of front-panel frequency switch setting.

52. Two monostables, respectively triggered by the 250 Hz reference and the 250 Hz "variable" waveforms, each provide a train of 30 us duration pulses which are applied to the tuning control circuits.

53. The control voltage supplied to the VFO is normally controlled by comparison of the relative phase of the two monostable outputs. Each pulse from the "variable" monostable triggers a negative going ramp and, at some time during the ramp, the pulse from the reference monostable causes the ramp to be sampled. The mean charge of a capacitor is determined by which portion of the ramp is sampled i.e. by the relative phase of the two monostable outputs. The capacitor voltage is filtered and attenuated before it is applied to the varactor diodes which control the VFO frequency.

54. If the VFO frequency falls below the correct value, the variable monostable will trigger the ramp later relative to the sampling pulse. Hence, the sample will be more positive and the control voltage is increased to increase the VFO frequency. The reverse will occur if the VFO frequency rises above the correct value. This fine control is effective only if the two monostable inputs differ in frequency by less than 1 Hz (if the VFO frequency shifts by less than 7.5 kHz at 3.175 MHz or 254 kHz at 31.75 MHz).

55. The circuit is said to be locked when the fine tuning control is effective. A loss of lock, due for example to changing the front panel switches, will occur when the inputs to the monostables differ in frequency by more than 1 Hz. A frequency comparator responds to differences in the two monostable outputs to cause:

(1) The level of the phase lock control signal supplied to Unit 6 to change from a low level to a high level.

(2) A pulse to occur on one of two lines according to whether the VFO frequency is high or low.

56. Pulses from the frequency comparator operate a reversible counter the output of which is decoded to select the degree of attenuation experienced by the control voltage. Thus, when the VFO frequency is low, a pulse from the comparator causes the counter to step down, thereby decreasing the attenuation by one step and causing an increase in output voltage. Successive pulses will modify the attenuation level in steps. The ramp is still sampled and causes the control voltage to move up in between the steps, however the attenuator switching causes a voltage overlap to occur and a fast pull down circuit operates to bring the voltage to an appropriate level. The VFO frequency will steadily rise as a result of this action and eventually the inputs to the monostables will differ by less than 1 Hz, at which point no further pulses will be produced by the frequency comparator, and the phase comparator will regain control with the correct attenuation selected.

57. A similar but opposite reaction will occur when loss of lock occurs with VFO frequency low.

58. Should the VFO be set to the wrong frequency range, loss of lock will be permanent and the system will settle with the control voltage at maximum (80V) or minimum (6V) according to whether the VFO frequency range is set too high or too low.

POWER SUPPLIES (see fig.4)

59. In any position of the power switch 1S2 other than OFF, +24V from the battery is connected to:

(1) External equipment via pin C of socket 2SK5 and 2SK6.

(2) To the relay driver in Unit 1a and, via socket 1SK1, to the Tx/Rx relay 2RLA/2.

(3) To the power supply module (Unit 5) where regulated d.c. supplies at 3V (temperature compensated), +6V, +12V and +110V are produced.

60. The +110V supply is used only within Unit 9 where a +105V supply is derived from it.

61. Two separate +6V supplies are produced, one for supply to the VFO and one for general use. Both supplies are taken through decoupling circuits in Unit 1.

TEST PROCEDURES

62. For all electrical test procedures, refer to the appropriate section (640/HA/09560-2b) in this part of the manual.

ASSEMBLY/DISASSEMBLY

63. For all assembly and disassembly procedures, refer to the appropriate section (640/HA/09560-2c) of this part of the manual.

REPAIR

General

64. On receipt for repair, proceed as follows:

(1) Open the set in the driest possible conditions and carry out anyur obvious repairs and replacements.

(2) Place the open set in a dehumidifier and dry for at least one hour at 50°C with dry air passing through the oven.

(3) After cooling, carry out the electrical functional tests in accordance with the procedures specified. Carry out any repair and alignment necessary to effect satisfactory completion of the tests.

(4) Dry the open set for 15 minutes (sub-para.(2) refers).

(5) Close the set (refer to assembly/disassembly procedures).

(6) Remove the desiccant holder from the unit and fit a one-way valve adaptor. Pressurise the unit to 5 lb/sq.in. (0.35Kg/cm^2 or 0.35 bar) and immerse in a water tank for a minimum of 2 minutes to check the need for the replacement of any spindle seals or gaskets. The addition of a wetting agent (i.e. detergent) to the water will assist the detection of leaks.

Release the pressure, remove the non-return valve, then fit the desiccator.

65. Any item returned to third line for repair should be protected by packing it into the container in which the replacement was received.

66. An item should not be removed from the radio unless it is definitely established as faulty and a replacement is available at second line. If either of these conditions cannot be satisfied, it is preferred that a complete assembly, or even the complete radio, be returned to the third line repair facility where repair can probably be effected with a minimum of dismantling.

67. Partial disassembly (ie. removal of screws etc, without unsoldering leads) to gain access to a particular sub-assembly is permissible. Care must be exercised that unscrewed items do not damage interconnecting wire leads or short to other items.

Repainting

68. Retouching of damaged surfaces may be carried out, but not repainting of a complete unit. Only the following paints should be used:

(1) Paint, priming. H1a/8020-99-224-2079.

(2) Paint, finishing, polyurethane, matt finish, deep bronze green. H1a/8010-99-224-8663.

COMPONENTS LIST

69. Refer to fig.5 for location of units.

70. A number of separate lists are given to facilitate identification of component parts of assemblies and sub-assemblies. In many instances, a complete breakdown of an item is not relevant at second line servicing level and is therefore omitted.

71. Receiver Transmitter RT320 640-1-09560 comprises:-

Description	Plessey Part No.	NATO Stock No
Front Panel and Chassis Assembly	640-1-09581	---
Rear Assembly Panel	640-1-09582	---
Case Assembly	640-1-09583	5820-99-622-8225
Gasket (2 off)	640-4-09585	5820-99-622-8226
Plug Mounting (desiccant)	418-9-37029	4440-99-624-3007
Desiccant Container M16	418-9-37030-001	4440-99-015-1390
Screw Special (28 off)	640-1-15079	---
Screw Special (4 off) (att.strap assemblies)	640-1-15335	---
Strap Assembly	640-1-14751	5820-99-622-8229
Strap Assembly	640-1-14746	5820-99-622-8228

72. The principal component parts of the Front Panel and Chassis Assembly 630-1-09581 comprises:-

Description	Plessey Part No.	NATO Stock No.
Turret Assembly (Unit 3)	640-1-09591	5820-99-622-8138
Tuner RF (ATU) (Unit 4)	640-1-09592	5820-99-622-8697
Power Supply (Unit 5)	640-1-09593	5820-99-622-7499
Panel electronic circuit (Unit 6)	419-1-12060	5820-99-622-5199

Screen and Can Assembly (Unit 6a)	640-1-09705	5820-99-622-8689
Screen and Can Assembly (Unit 6b)	640-1-09706	5820-99-622-7501
Screen and Can Assembly (Unit 6c/6d)	640-1-37537	5820-99-622-7500
Screen and Can Assembly (Unit 6e)	630-1-47542	5820-99-622-8690
Oscillator RF (Unit 8)	640-1-15074	---
Synthesiser Assembly (Unit 9)	682-1-00400	5820-99-110-3480
Panel electronic circuit (Unit 1a)	419-1-11815	5820-99-622-8688
Cableform No.1 assy.	702-1-08250	5820-99-622-8235
Cableform No.2 assy	702-1-08251	5820-99-622-8215
Meter	682-9-01577-001	6625-99-624-4229
Switch (1S1)	408-8-47814-003	5930-99-622-8951
Switch (1S2)	408-9-47812-002	5930-99-622-8950
Switch (1S5)	408-9-24810-010	5820-99-622-8222
Switch (1S6)	408-9-24810-005	5820-99-622-8237
Switch (1S7)	408-9-24810-006	5820-99-622-8238
Switch (1S8)	408-9-24810-007	5820-99-622-8239
Switch (1S9)	408-9-24810-008	5820-99-622-8240
Switch (1S10)	408-9-24810-009	5820-99-622-8223
Capacitors fixed dielectric (1C1)	640-1-09597	5910-99-622-8213
Resistor variable 4.7k ±20.0% 0.5W (1R2)	404-9-05029-001	---
Resistor 4.7 ohm ± 5% 10W (1R1)	403-4-06950-470	5905-99-015-5514
Filter Bandpass (1FL1)	428-9-05003	5915-99-622-5003
Filter Bandpass (1FL2)	428-9-05004	5915-99-622-5004
Filter Bandpass (1FL3)	428-9-05005	5915-99-622-5005
Knob (for GAIN and TUNE controls)	418-9-07532-100	5355-99-622-8945
Knob (for RANGE Sw)	418-9-07534-100	5355-99-622-8167
Knob (for FREQUENCY RANGE Sw)	418-9-07533-100	5355-99-622-8169
Knob (for 1S6 to 1S9)	418-9-07524-001	5355-99-622-8170
Knob (for 1S5)	418-9-07524-002	5355-99-622-8171
Knob (for 1S1, 1S2 and LOAD Sw)	418-9-07523-100	5355-99-622-8172
ATU drive spindle stop assy.	640-1-22611	5820-99-652-6097
Turret drive spindle assy.	640-1-14920	5820-99-622-8687
Turret drive plate coupling assy.	640-1-14913	5820-99-622-8220
Battery contacts comprising:		
Bush (2 off)	640-2-09610	--
Pad contact (2 off)	640-2-09612	--
Seal (4 off)	640-2-09613	--

73. The principal component parts of the Rear Panel Assembly 630-1-09582 are:

Description	Plessey Part No.	NATO Stock No.
PA Switch and Filter assy. containing:	640-1-09631	5820-99-622-8692
Panel Electronic Circuit (Unit 2b)	419-1-11830	5820-99-622-5198

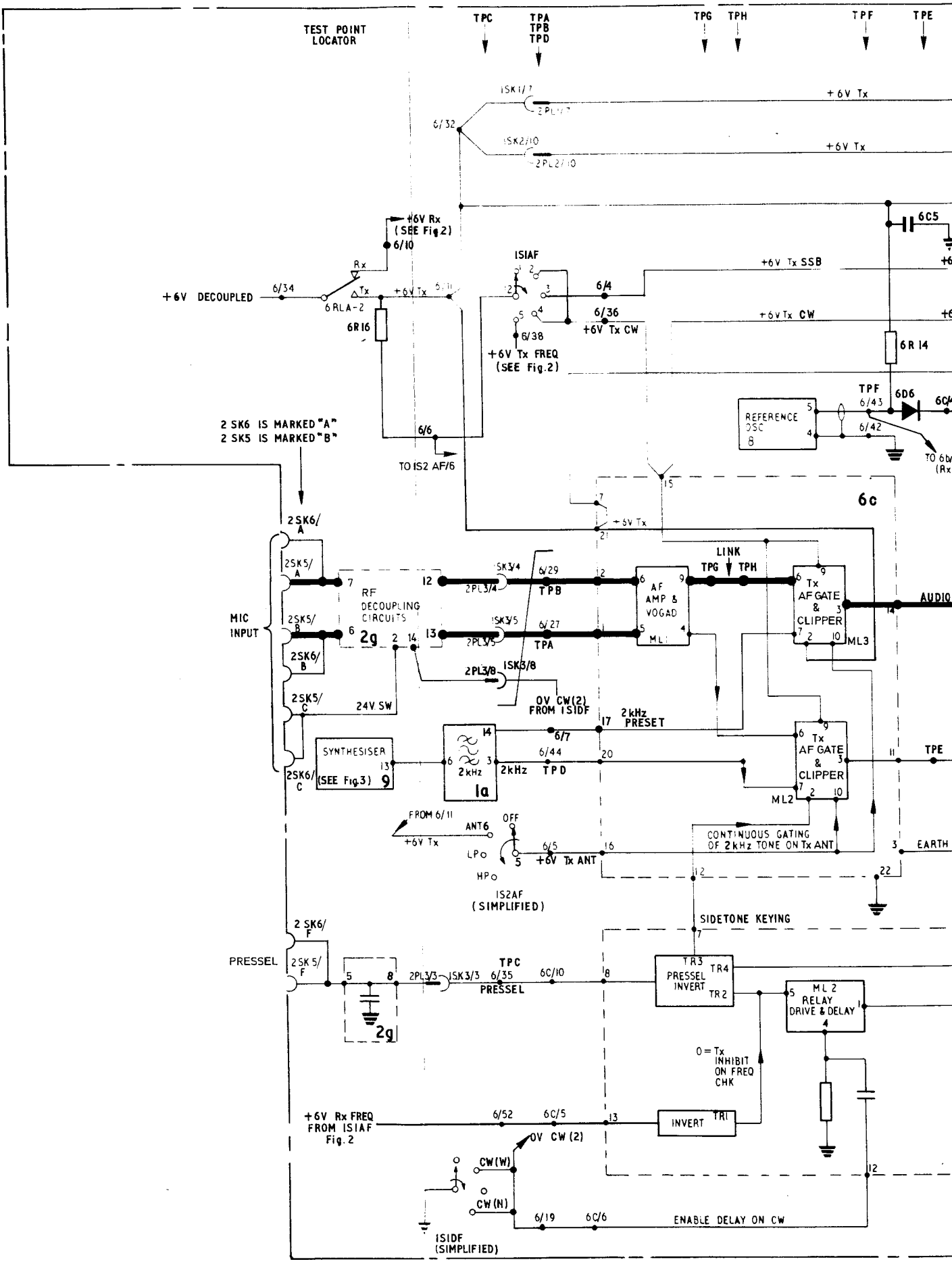
PA Filter (Units 2c-2f)	640-1-09734	---
Panel Electronic Circuit (Unit 2a)	419-1-11820	5820-99-624-4196
Panel Electronic Circuit (Unit 2g)	419-1-11855	5820-99-622-5203
Filter (Unit 2h)	640-1-09648	5915-99-622-8696
Plug, electrical (link assy.)	509-1-20945	--
Socket, electrical, fixed	508-9-23903	5935-99-622-7377
Screw special (att. PA Switch and Filter assy.)	640-2-09635	5820-99-622-8683

74. The principal components parts of the case assembly 640-1-09583 are:

Description	Plessey Part No.	NATO Stock No.
Whip, socket:		
Ring sealing	999-4-01116-001	--
Spring	640-2-09644	--
Socket antenna assy.	640-1-09760	--
Contact	640-2-09643	--
Terminal screw	703-4-98258	5940-99-012-0234
Block antenna - top	640-2-09641	--
Block antenna - bottom	640-2-09642	--
Torroidal sealing ring	999-4-01116-018	--
Terminal, spring head	703-4-98481-002	5940-99-901-3609

75. Connectors which are part of cableform assemblies etc are as follows:

Description	Plessey Part No.	Part of
Socket electrical 1SK1	508-9-29632)	
Socket electrical 1SK2	508-9-29631)	
Socket electrical 1SK3	508-9-29633)	Cableform
Plug electrical, coax (inserts for 1SK1,1SK2)	508-9-20405))	No.1
Plug assembly (1PL4)	640-1-09748)	
Socket, electrical (5SK4)	508-9-21650	Unit 5a
Plug electrical 2PL1	508-9-21630	Unit 2b
Plug electrical 2PL2	508-9-21629	Unit 2a
Plug electrical 2PL3	508-4-21513-001	Unit 2g
Socket electrical, coax (inserts for 2PL1,2PL2)	508-9-20404	Unit 2b
Socket electrical (2SK5, 2SK6)	508-9-20411	Unit 2g
Socket, coaxial (2SK7, 2SK8)	508-9-21609	Unit 2



Transmission section

Fig. 1 SHT. 1

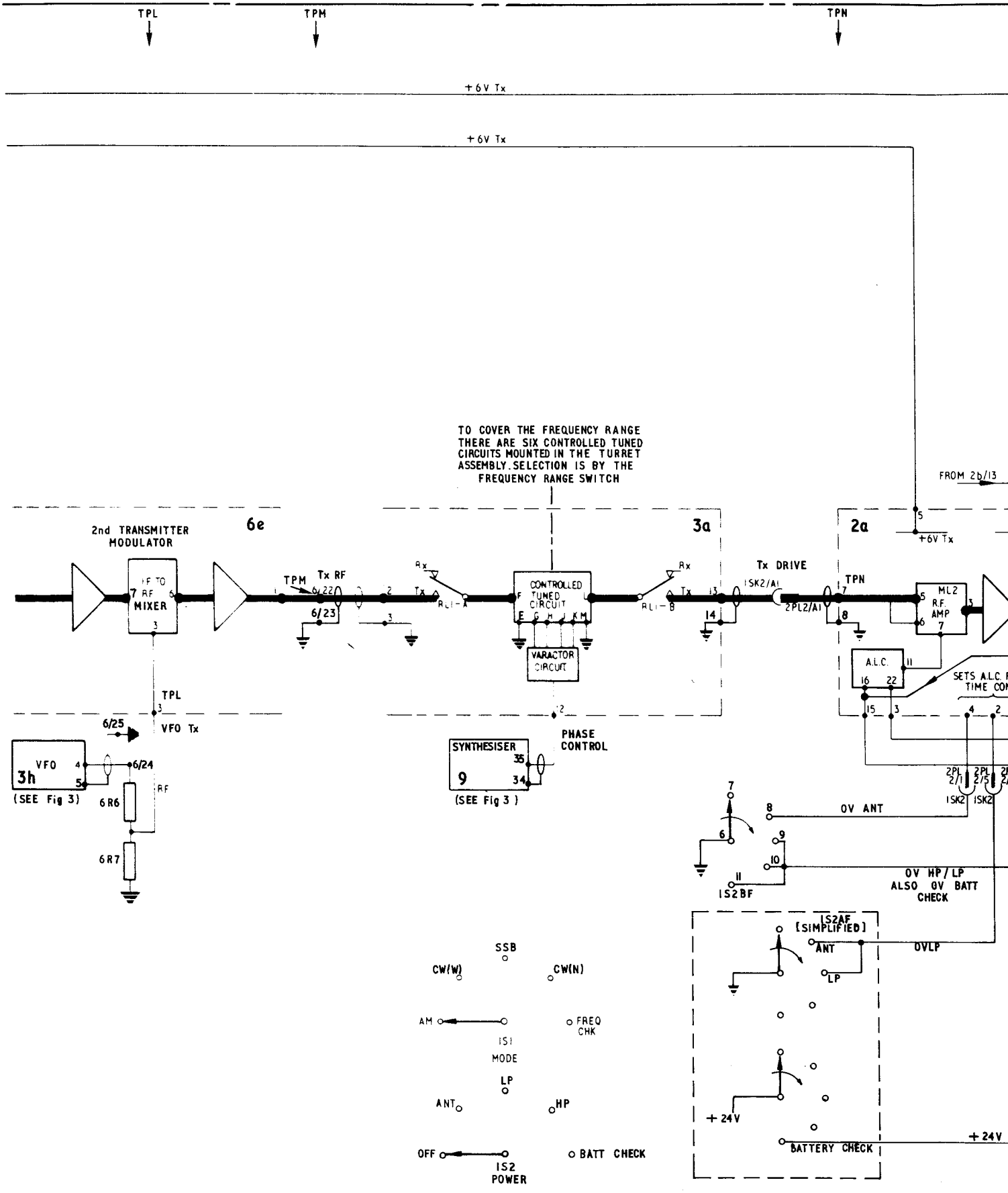
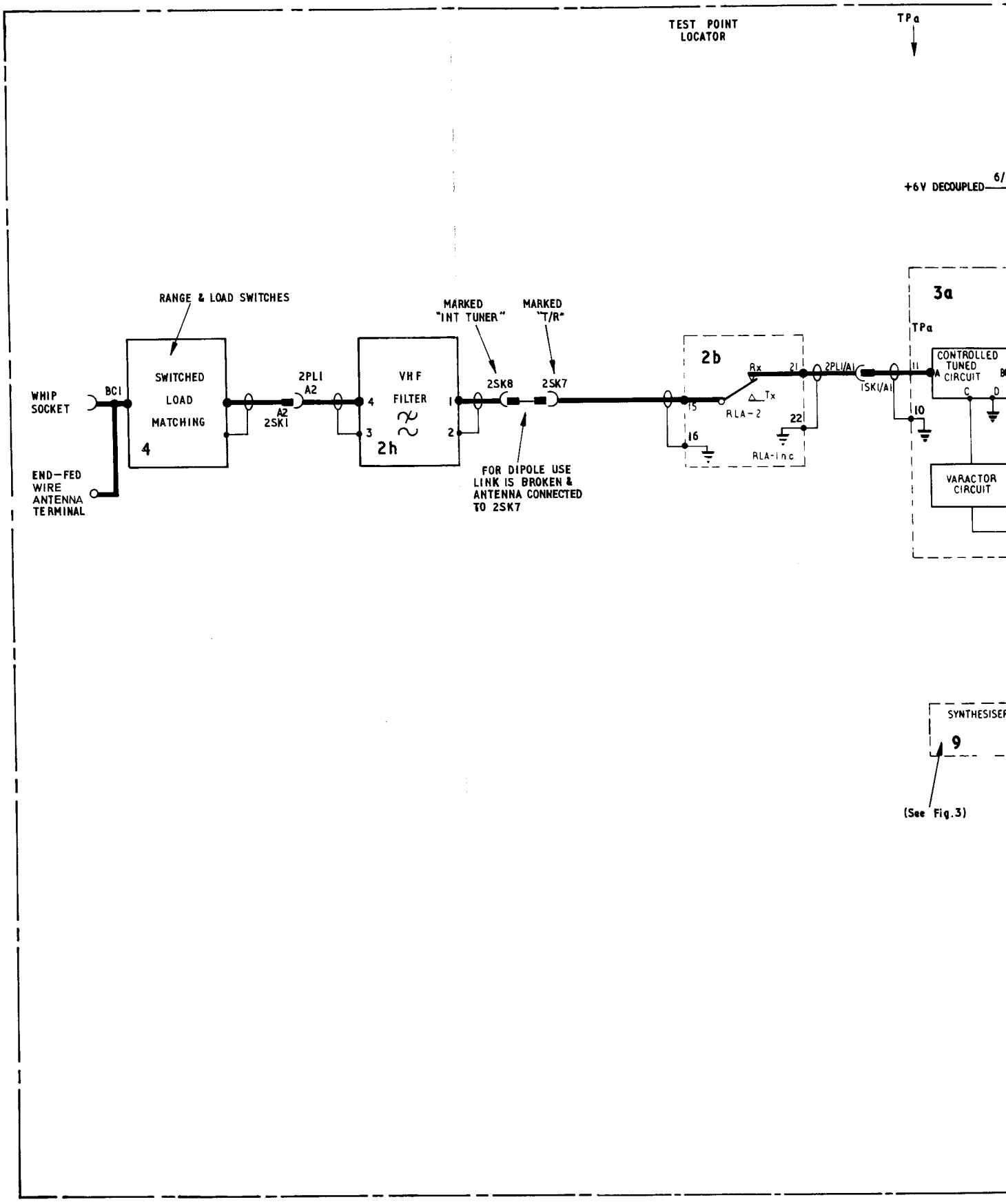


Fig. 1

Transmission section - function

May 81



Reception section – func

Fig.2 SHT.1

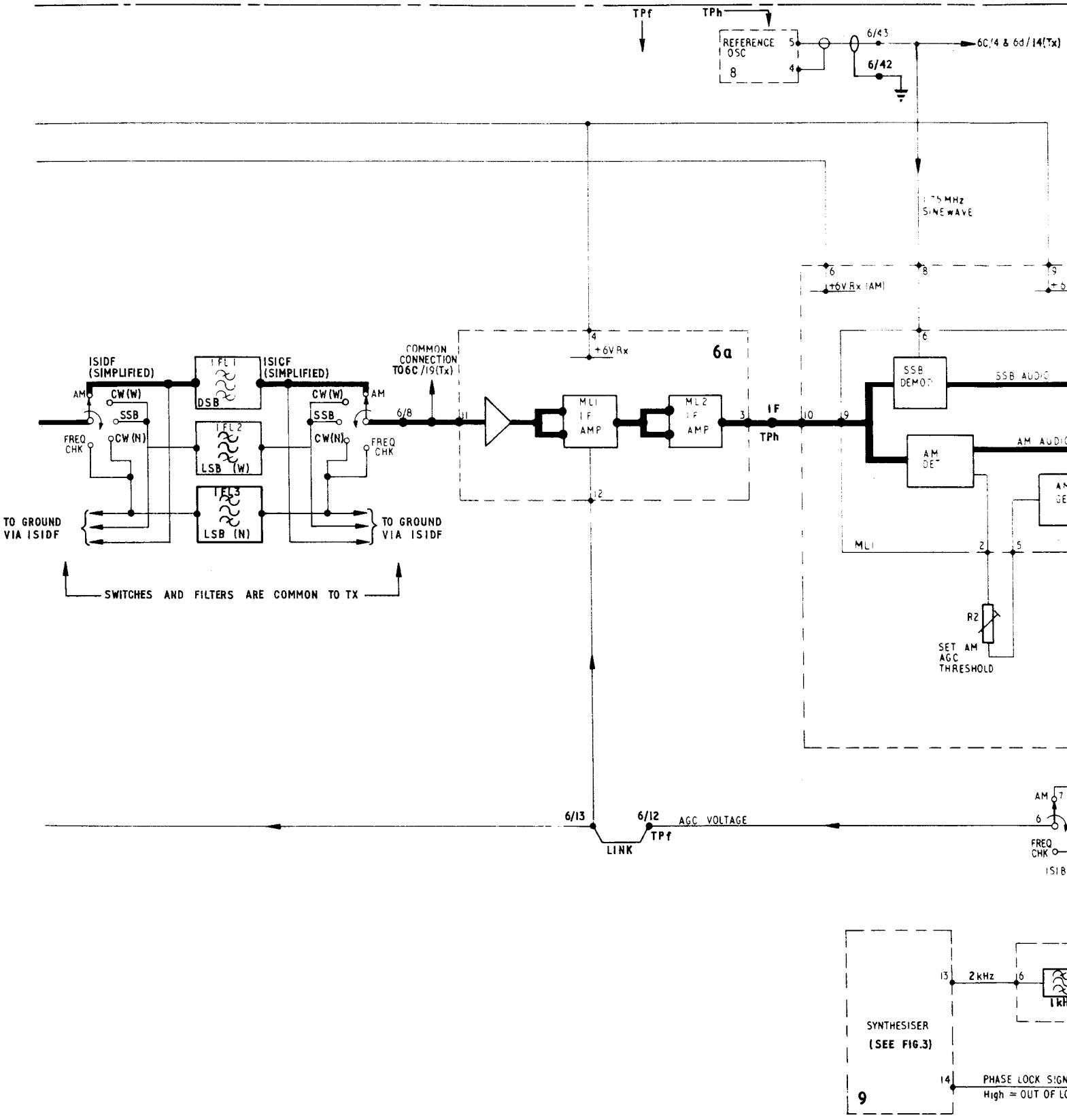
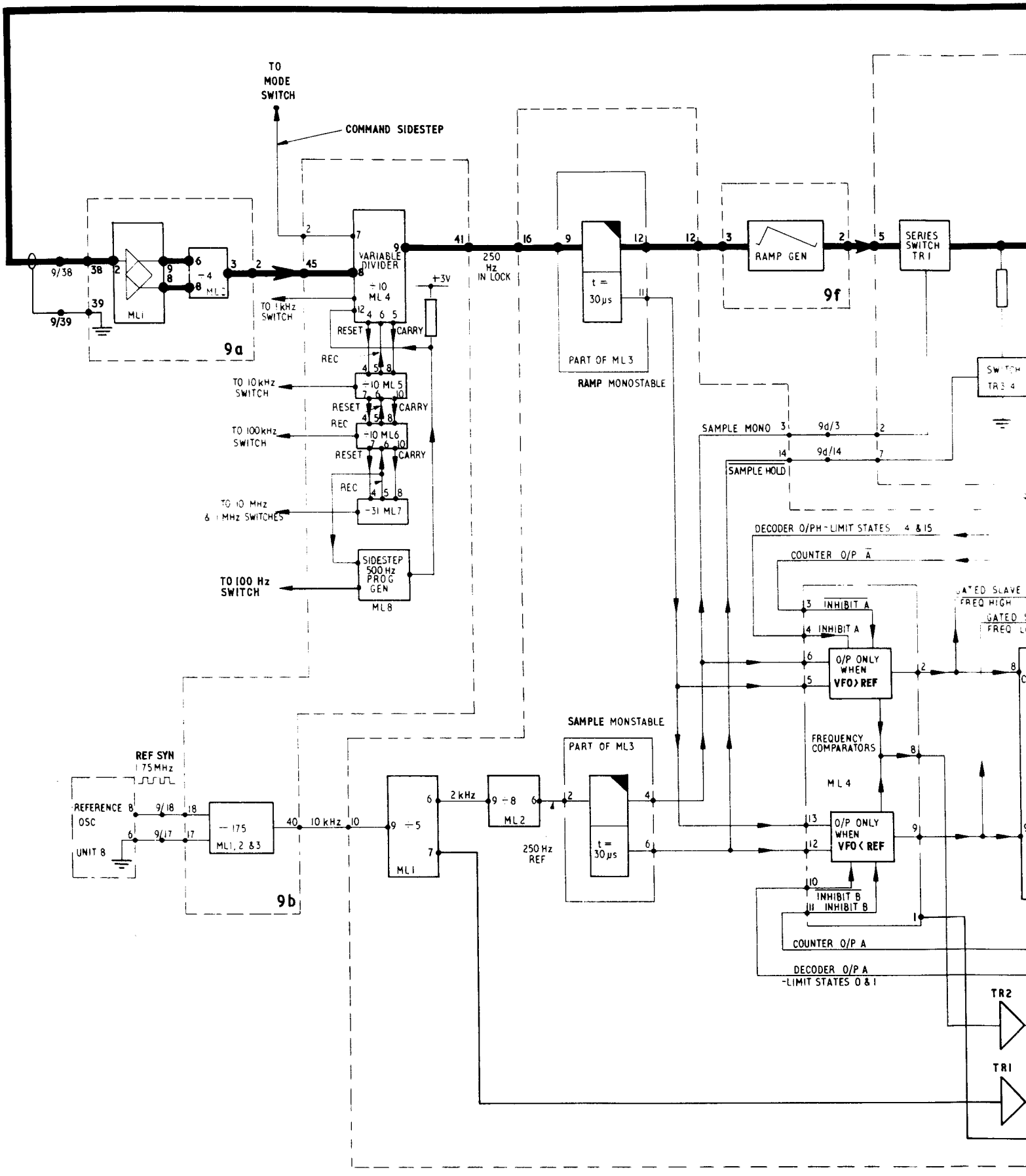


Fig.2

Reception section – functional block

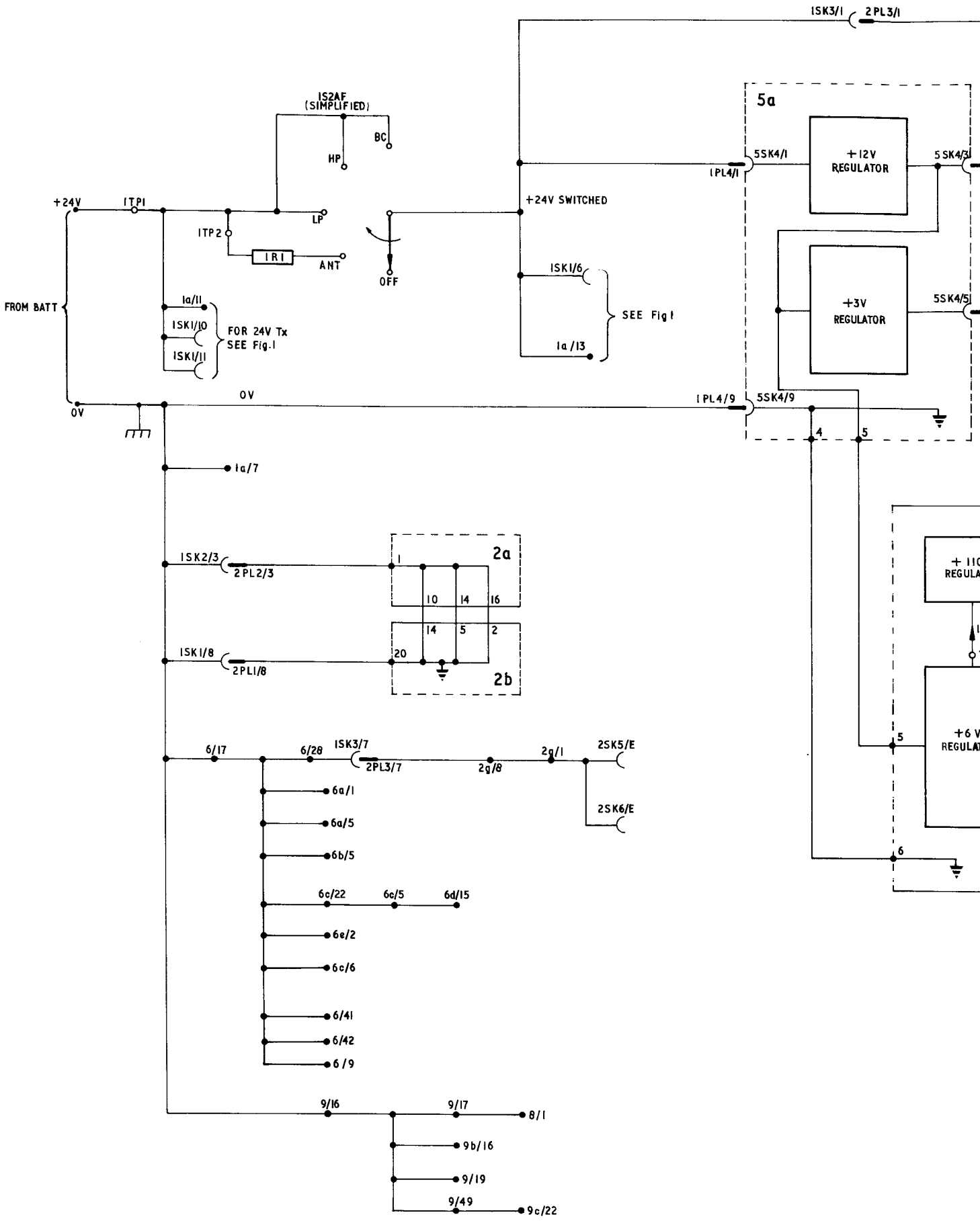
May 81



Frequency synthesiser – interconnections

Fig.3

May 81



Power supplies — functional block and

Fig. 4

May 81

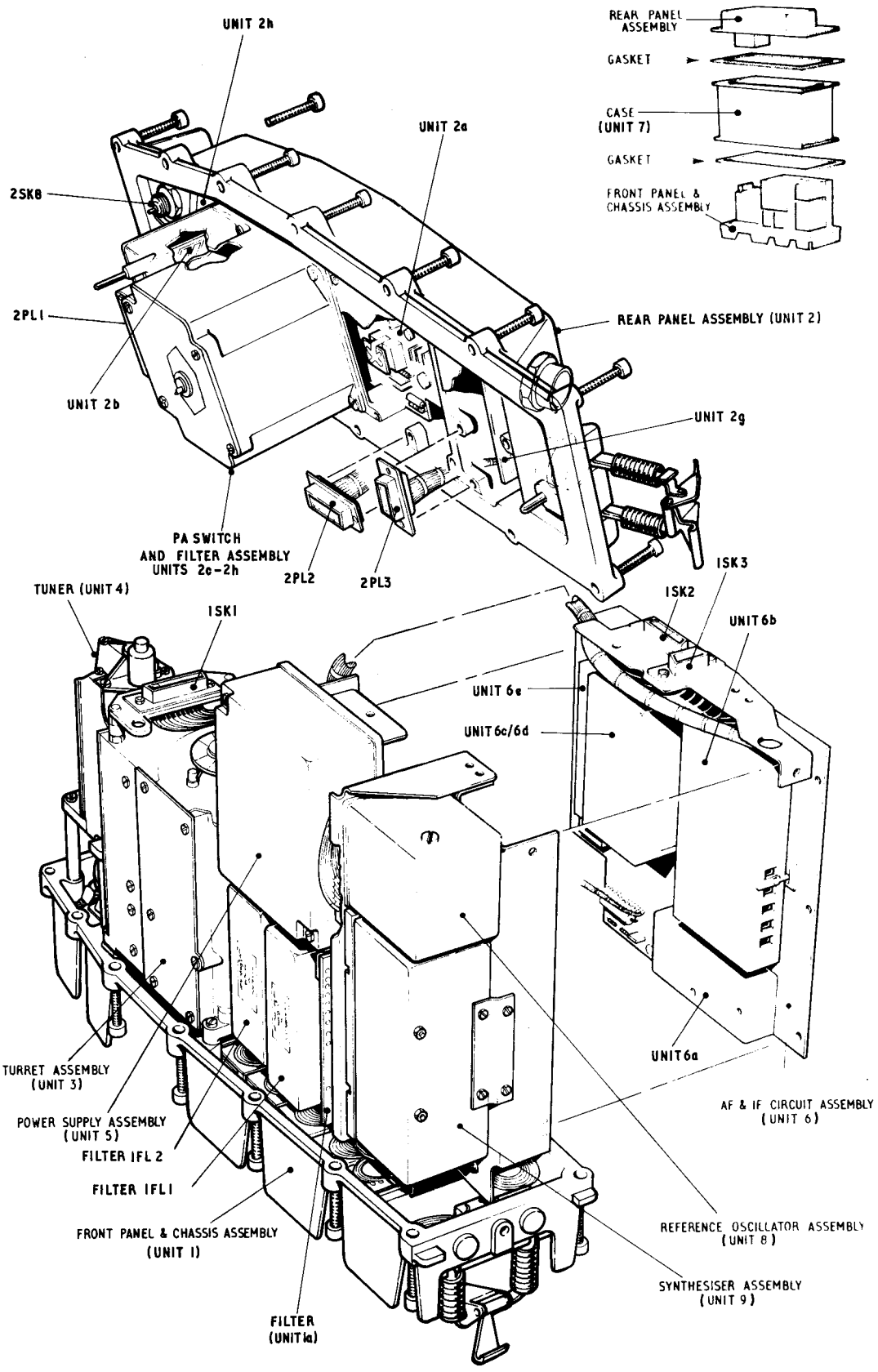


Fig.5 Receiver transmitter - breakdown

ELECTRICAL TESTING

OF

RECEIVER TRANSMITTER RT320

CONTENTS

	Para.
Introduction	1
Test equipment	4
TEST PROCEDURES	
Performance checks	6
Preliminary	7
Current consumption	10
Transmitted frequency accuracy	12
Synthesiser logic	14
Transmitter output power (CW)	16
Transmitter mean power output and modulation depth (AM)	18
Phase lock indication	20
Sidetone level	22
Pressel characteristics	24
Audio sockets pin C.	26
Battery voltage monitor	28
Output indication	30
Antenna tuning	32
Receiver sensitivity	34
Frequency check facility	36
Signal + noise/noise ratio	38
AGC operation	40
Alignment procedures	
Introduction	42
Random monitoring	43
Preliminary	44
PSU (Unit 5) alignment	46
Unit 2 bias current check	54
Driver and PA bias adjustment (Unit 2a)	55
ALC adjustment (Unit 2a)	56
Low level drive levels (Unit 6 adjustments)	57
Clipping threshold (Unit 6c)	58
AGC adjustment (Unit 6)	59
Battery voltage indication	60
Oscillator alignment (Unit 3)	61
Reference oscillator	62
VHF filter attenuation	63
Fault finding	66
Preliminary	68
Test points	69
Current consumption	70
Transmitted frequency accuracy	73
Synthesiser logic	74
Transmitted output power (CW)	77
Transmitter mean power output and modulation depth (AM)	78
Phase lock indication	79
Sidetone level	80
Antenna tuning	81
Receiver sensitivity	82
Signal + noise/noise ratio	84
AGC operation	85

TABLES

Table		Page
1	Oscillator tracking	22
2	RF tuned circuit tracking	22
3	Typical current levels	25
4	Frequency setting switch code	26
5	Synthesiser - typical output levels	26
6	Typical test data - transmitters	27
7	Typical test data - receiver	29

ILLUSTRATIONS

	Fig.
Unit 6 - terminal pin and test point locations	1

APPENDICES

App.1 Calibration of Temperature Controlled Reference Oscillator (Unit 8)

INTRODUCTION

1. The procedures given in this section detail the steps necessary to electrically test the transmitter receiver unit at the second line repair facility.

2. All tolerances quoted include an allowance for test equipment inaccuracies.

3. Also included in this section are notes on fault finding.

4. The appendix to this section defines calibration of the temperature controlled reference oscillator unit which should be carried out at the second line facility, at locally determined intervals.

NOTES: 1. Functional testing of the ATU and VHF filter cannot be carried out at second line on an open unit.

2. If the unit is open (i.e. cover removed) the mechanical link between the turret and PA filter switch is broken and the two switches must be individually set to the same range.

TEST EQUIPMENT

5. The following items of special-to-purpose test equipment are required:

(1) Test Rig Electronic Equipment MK II, 675/9/27805/002.

(2) Test Kit Radio, 640/1/15436.

NOTE: The following abbreviations are used throughout:

TRE - Test Rig Electronic
TKR - Test Kit Radio
UUT - Unit Under Test
DVM - Digital Voltmeter
RFG - RF Signal Generator (on TRE)
fo - frequency of transmission of UUT, which is the frequency set on the UUT front panel frequency controls irrespective of mode.

TEST PROCEDURES

PERFORMANCE CHECKS

6. These checks are to ensure that the major performance parameters are correct and that all the controls are operating satisfactorily. A transceiver must satisfy all the checks before it can be passed as serviceable.

Preliminary

7. Connect the test equipment as follows, using the cables supplied with the TRE:

(1) At the TRE connect the inputs of the counter, DVM and Modulation Meter to their associated cables on the TRE front panel (see NOTE below.)

(2) Connect RFG output to SIG GEN I/P on connector on TRE.

(3) Connect the UUT battery terminals to the TRE SUPPLY connector.

(4) Connect the UUT T/R socket to the TRE RF I/P O/P connector.

(5) Connect the UUT socket 2SK5 to the TRE AUDIO socket.

(6) If the radio is open:

(a) Mount the front panel and chassis assembly on the stand provided with the Test Kit Radio, with the Mother Panel (Unit 6) protected by the shield provided with the test kit.

(b) Connect the RT 320 Test Unit between the front and rear panel assemblies and ensure that the test unit TEST SELECT switch is set to 6.

NOTE: A short flying lead protruding from the TRE front panel provides connection of the adjacent measuring instrument. In the following procedures, the instruction "externally connect" requires the designated instrument input to be disconnected from the internal circuits and, using the appropriate cable or probe, connected to the required external circuit.

8. Set the PSU VOLTS switch to 24V. Set PSU switch ON. Check the supply voltage to the UUT thus:

(1) At the TRE set the DVM FUNCTION switch to PSU VOLTS and DVM range to 100V dc.

(2) Check that the DVM reading is 24V $\pm$ 0.1V.

9. For all tests, unless otherwise stipulated, the following TRE switch settings will be maintained:

AF OSCILLATOR to T/R MIC LOW
LINE TERMINAL LOADING to O/C
Tx/Rx switch to Rx
PSU VOLTS to 24V
(Ensure that the 50H Power Meter element is fitted)

NOTES: 1. When the DVM FUNCTION switch is set to OSCILLATOR O/P the DVM reads P.D. except when the AF OSCILLATOR switch is set to the T/R MIC positions. In this case the DVM reads EMF +20 dB.

2. Each time the mains supply to the RFG is interrupted, or r.f. is applied to the RFG output, it is necessary to reset the RF Trip before setting an output level.

3. Do not set the Tx/Rx switch to Tx for longer than is necessary to make the required readings/observations.

4. Power may be disconnected from the UUT at any time by setting the PSU switch to OFF.

5. If an excessive voltage is selected by the VAR SUPPLY control, the PSU overvoltage may trip. To restore the supply, set the VAR SUPPLY control anticlockwise and set the PSU switch to OFF. Wait 5 sec and then set the PSU switch to ON.

Current consumption

10. This test checks, with a supply voltage of 24V, that the dc input current levels on receive, transmit HP and transmit LP do not exceed specified levels.

11. Proceed as follows:

(1) At the UUT set:

CW(W)
2.5000 MHz (with RANGE 2 - 3.1)
HP
GAIN fully anti-clockwise

(2) At the TRE, set DVM FUNCTION switch to UUT CURRENT and DVM range to 1V dc.

(3) Check that the DVM reads less than 0.017V maximum (i.e. 170 mA current).

(4) At the TRE set Tx/Rx switch to Tx. Check that, after 5 seconds, the DVM reads less than 0.26V maximum (i.e. 2.6A current). Set Tx/Rx switch to Rx.

(5) At the UUT select HP, 25 MHz with RANGE 19.1 - 30. Repeat sub-para.(4).

(6) At the UUT select LP.

(7) At the TRE set Tx/Rx switch to Tx. Check that, after 5 seconds, the DVM reads less than 0.12V maximum (i.e. current 1.2A). Set Tx/Rx switch to Rx.

Transmitted frequency accuracy

12. This test checks that the transmitter output frequency accuracy is better than 1 part in 10^6 when averaged over a period of 10 seconds.

13. Proceed as follows:

(1) At the UUT set:

AM
20.0000 MHz with RANGE 19.1 - 30
LP
GAIN fully anti-clockwise

(2) At the TRE set:

AF OSCILLATOR switch to OFF
COUNTER to 0.1 Hz resolution (Hz)

(3) At the TRE set Tx/Rx switch to Tx and check that the counter reads 0000020.0 maximum to 9999980.0 minimum (i.e. 20.000 020 MHz to 19.999 980 MHz). Set Tx/Rx switch to Rx.

(4) At the TRE set counter to 1 Hz resolution (kHz). At the TRE set Tx/Rx switch to Tx. Check that, after 10 sec, the difference between successive counts is less than 10 Hz for not less than 10 counts. Set Tx/Rx switch to Rx.

Synthesiser logic

14. This tests checks each setting of the UUT frequency switches.

15. Proceed as follows:

(1) At the UUT set:

AM
LP
GAIN fully anti-clockwise

(2) At the TRE set:

AF OSCILLATOR switch to OFF
Counter to 1 Hz resolution (kHz)

(3) Set the UUT frequency and range to each of the following settings in turn. For each step, at the TRE set Tx/Rx switch to Tx, check that after 10 sec the counter reading is within the limits given and that the difference between successive count is less than 10 Hz, then set Tx/Rx switch to Rx.

UUT Frequency	UUT RANGE	COUNTER READING Max.	Min.
20.0000 MHz	19.1 - 30	20.000020 to	19.999980
11.1111 MHz	7.7 - 12.2	11.111111 to	11.111089
02.2222 MHz	2 - 3.1	02.222202 to	02.222198
03.3333 MHz	3.1 - 4.9	03.333303 to	03.333297
04.4444 MHz	3.1 - 4.9	04.444404 to	04.444396
05.5555 MHz	4.9 - 7.7	05.555505 to	05.555495
16.6666 MHz	12.2 - 19.1	16.666616 to	16.666584
17.7777 MHz	12.2 - 19.1	17.777717 to	17.777683
18.8888 MHz	12.2 - 19.1	18.888818 to	18.888782
29.9999 MHz	19.1 - 30	29.999929 to	29.999871

Transmitter output power (CW)

NOTE: Measurement of output power is affected by the alc action in the power amplifiers. Peak measurements must be made before this action takes effect (i.e. in the first second) and mean measurements after this action (i.e. after at least 5 seconds).

16. This test checks that, with a supply of 24V, the PEP output when transmitting CW HP is between specified limits when measured between 0.1 and 1 second after commencing transmission. It also checks that the power output after at least 5 seconds continuous transmission is within limits, that these outputs are reduced by 3.0 dB when the supply voltage is reduced to 20V and that the output is reduced by 9 to 13 dB when switched to LP. Both CW(W) and CW(N) are checked by this test.

17. Proceed as follows:

(1) At the UUT set:

CW(W)
2.5000 MHz with RANGE 2 - 3.1
HP
GAIN fully anti-clockwise

(2) At the TRE set AF OSCILLATOR switch to OFF.

(3) At the TRE set Tx/Rx switch to Tx and check that the Power Meter reads between 17.5W minimum and 35.5 maximum.

(4) After at least 5 secs, check that the Power Meter reads 5.5W minimum to 16.5W maximum.

(5) At the TRE set Tx/Rx switch to Rx.

(6) Set DVM FUNCTION switch to PSU VOLTS and DVM range to 100V dc. Set PSU VOLTS switch to 16-32V and adjust VAR SUPPLY control until the DVM reads 20 $\pm$ 0.1V.

(7) Set Tx/Rx switch to Tx. After at least 5 seconds, check that the Power Meter reads 2.5W minimum to 9.5W maximum. Set Tx/Rx switch to Rx.

(8) Set UUT to 25 MHz, repeat (7).

(9) Set UUT to LP and at TRE set PSU VOLTS to 24V switch and change to 5A element.

(10) At the TRE set Tx/Rx switch to Tx. After at least 5 seconds, check that the Power Meter reads 0.15W minimum to 2.00W maximum. Set Tx/Rx switch to Rx.

(11) Set UUT to HP and CW.

(12) At the TRE change to 50H element. Set DVM FUNCTION switch to UUT CURRENT and DVM range to 1V dc.

(13) Set the UUT frequency range to each of the following settings in turn. For each step, at the TRE, set Tx/Rx switch to Tx, wait for at least 5 seconds, check that the Power Meter reads 5.5 minimum to 16.5W maximum and that the DVM reads 0.26V maximum (2.6A), then set Tx/Rx switch to Rx.

Frequency	RANGE
2.5000 MHz	2.0 - 3.1
4.0000 MHz	3.1 - 4.9
6.5000 MHz	4.9 - 7.7
10.0000 MHz	7.7 - 12.2
16.0000 MHz	12.2 - 19.1
25.0000 MHz	19.1 - 30

(14) Set the UUT to HP, 25.0000 MHz with range 19.1 - 30.

(15) Repeat (3) and (5).

(16) Set the UUT to CW(N)

(17) Repeat (3), (4) and (5)

Transmitter mean power output and modulation depth (AM)

18. This test checks that:

(1) The unmodulated AM output power after at least 5 seconds of continuous transmission is between specified limits and that this output is reduced by 9 to 15 dB when the UUT is switched to ANT.

(2) The modulation depth is between 70 and 100% with any AF input level between 0.4 mV and 40 mV at 2 kHz.

19. Proceed as follows:

(1) At the UUT set:

AM
25.0000 MHz with RANGE 19.1 - 30.
HP
GAIN fully anti-clockwise

(2) At the TRE set AF OSCILLATOR switch to OFF.

(3) At the TRE set Tx/Rx switch to Tx. Check that, after 5 secs, the Power Meter reads 5.5W minimum to 16.5W maximum. Reset Tx/Rx switch to Rx

(4) Set UUT to SSB and ANT. Change to 5A element.

(5) Set Tx/Rx switch to Tx, check that the Power Meter reads 2.0W maximum. Set Tx/Rx switch to Rx.

(6) Set the AF OSCILLATOR switch to T/R MIC LOW.

(7) Set the UUT to AM and LP.

(8) At the TRE:

Set DVM FUNCTION switch to OSCILLATOR O/P and DVM range to 1.0V ac

Adjust VAR 2 kHz control until the DVM reads 0.004V $\pm$ 0.002V (0.4 mV at UUT)

Set Modulation Meter to AM, 0 dB, -ve, 100%.

(9) At the TRE set Tx/Rx switch to Tx. Check that the Modulation Meter reads 70% minimum to 100% maximum. Reset Tx/Rx switch to Rx.

(10) Set the AF OSCILLATOR switch to TR MIC HIGH and adjust VAR 2 kHz control until the DVM reads 0.4V $\pm$ 0.01V (40 mV at UUT).

(11) Repeat (9).

(12) Change to 50H element.

Phase lock indication

20. This test checks that, with the frequency controls mis-set, the loss of lock 2 kHz continuous tone is produced, the AF output into 100 ohm, is at the appropriate level of between 100 uW and 2.0 mW, and the transmitter RF output is reduced to less than 100 mW.

21. Proceed as follows:

(1) At the UUT set:

CW(W)
2.5000 MHz with RANGE 3.1 - 4.9.
LP
GAIN fully anti-clockwise

(2) At the TRE set:

DVM FUNCTION switch to AUDIO O/P and DVM range to 1.0V ac
AF OSCILLATOR switch to OFF

(3) Check that a continuous tone is present at the loudspeaker.

(4) Check that the DVM reads 0.1V minimum to 0.45V maximum.

(5) Set Tx/Rx switch to Tx. Check that the Power Meter reads less than 0.1W maximum. Set Tx/Rx switch to Rx.

Sidetone level

22. This test checks that, with an audio input of 2 KHz at 12 mV, the appropriate sidetone output level is produced for SSB or AM and is attenuated by the correct amount for CW modes.

u

23. Proceed as follows:

(1) At the UUT set:

AM
2.5000 MHz with RANGE 2 - 3.1
HP
GAIN fully clockwise

(2) At the TRE set:

DVM FUNCTION switch to OSCILLATOR O/P and DVM range to 1.0V ac
AF OSCILLATOR switch to T/R MIC HIGH
Adjust VAR 2 kHz control until the DVM reads 0.12V $\pm$ 0.01V

(3) Set DVM FUNCTION switch to AUDIO O/P.

(4) Set Tx/Rx switch to Tx and check that the DVM reads 0.27V minimum to 0.47V maximum. Set Tx/Rx switch to Rx.

(5) Transfer the cable at UUT 2SK5 to 2SK6 and repeat (4). (This checks other socket). Replace the cable on 2SK5.

(6) Set UUT to CW(W). At the TRE set Tx/Rx switch to Tx and check that the DVM reads 0.047V minimum to 0.1V maximum. Set Tx/Rx switch to Rx.

Pressel characteristics

24. This test checks the pressel voltage and current.

25. Proceed as follows

(1) At UUT set:

CW(W)
2.5000 MHz with RANGE 2 - 3.1
LP
GAIN fully clockwise

(2) At the TRE set:

DVM FUNCTION switch to PRESSEL and DVM range to 10V dc
Tx/Rx switch to Rx

(3) Check that DVM reads 1.8V minimum to 2.4V maximum.

(4) Set the DVM range to 100 mV d.c.

(5) Set Tx/Rx switch to Tx and check that the DVM reads less than 30 mV maximum. Set Tx/Rx switch to Rx.

Audio sockets pin C

26. This check verifies that a 24V supply is present at pin C of 2SK5 and 2SK6, and that the drain from this supply is reduced to less than 200 mA after it has been short circuited.

27. Proceed as follows:

(1) At the TRE set:

DVM FUNCTION switch to REMOTE SUPPLY and DVM range to 100V dc
AF OSCILLATOR switch to OFF

(2) Set UUT to LP and check that the DVM reads greater than 23.5V minimum.

(3) At the TRE depress PIN C switch. After an initial surge check that the DVM reads less than 0.2V maximum. Release the PIN C switch.

(4) Remove the TRE lead connected to UUT 2SK5, and connect it to UUT 2SK6. Repeat steps (1) to (3), and check that the same results are obtained.

Battery voltage monitor

28 This test checks the calibration of the battery check circuits by verifying the meter reading at selected supply voltage levels.

29. Proceed as follows:

(1) At the UUT set:

CW(W)
2.5000 MHz with RANGE 2 - 3.1
BATT CHK
GAIN fully anti-clockwise

(2) At the TRE set:

DVM FUNCTION switch to PSU VOLTS and DVM range to 100V dc
PSU VOLTS switch to 16-32V

(3) At the TRE adjust VAR SUPPLY control to set the UUT meter indication exactly on the first mark from zero (20% FSD).

(4) Check that the DVM reads 19.5V minimum to 20.5V maximum.

(5) Adjust the VAR SUPPLY control until the DVM reads 32 $\pm$ 0.5V.

(6) Check that the UUT meter reads 70% FSD minimum to 100% FSD maximum.

(7) At the TRE set PSU VOLTS switch to 24V.

(8) Check that the UUT meter reads 30% FSD minimum to 60% FSD maximum.

Output indication

30. This test checks that the reflectometer circuits provide the appropriate UUT meter indication for various modes thus:

(1) Operating into a 50 ohm load on CW(W), LP and HP.

(2) Operating into various loads on ANT.

31. Proceed as follows:
(1) At the UUT set:

CW(W)
2.0000 MHz witah RANGE 2 - 3.1
HP
GAIN fully anti-clockwise

(2) At the TRE set PSU VOLTS switch to 24V

(3) Set Tx/Rx switch to Tx, wait at least 5 secs, check that the UUT meter indicates greater than 30% FSD minimum. Set Tx/Rx switch to Rx.

(4) At the UUT, set LP and repeat (3).

(5) At the UUT, set ANT.

(6) Set Tx/Rx switch to Tx, check that the UUT meter reads greater than 60% FSD minimum. Set Tx/Rx switch to Rx.

(7) Remove the antenna lead from the T/R socket of the UUT. Set Tx/Rx switch to Tx and check that the UUT meter reads less than 20% FSD maximum. Set Tx/Rx switch to Rx.

(8) Short the T/R socket of the UUT with the BNC short circuit provided. Set Tx/Rx switch to Rx and check that the UUT meter reads less than 20% FSD. Set Tx/Rx switch to Rx.

Antenna tuning

32. This test checks the ATU by verifying that, with the whip outlet connected to a 50 ohm load via a 35 pF capacitor, it is possible to tune through a peak deflection (more than 60% FSD) on the UUT meter at 2 MHz and at 29.999 MHz.

33. Proceed as follows:

(1) At the UUT set:

CW(W)
2.0000 MHz with RANGE 2 - 3.1
ANT
RANGE A
LOAD 5
Link between T/R and INT TUNER sockets

(2) Fit coupler, dummy antenna (part of Test Kit Radio) to UUT whip antenna socket. Connect RF I/P O/P socket to coupler.

(3) At the TRE set AF OSCILLATOR switch to OFF.

(4) Set Tx/Rx switch to Tx. Operate the TUNE and LOAD controls to obtain a peak deflection on the UUT meter. Check that the UUT meter reads greater than 60% FSD minimum. Set Tx/Rx switch to Rx.

(5) At the UUT set 29.9990 MHz with RANGE 19.1 - 30 and E. Repeat (4).

(6) At the UUT set 2.8 MHz with RANGE 2 - 3.1 and A. Disconnect coupler. Repeat (4) and switch to HP.

(7) Set Tx/Rx switch to Tx. There should be no breakdown in the antenna tuning circuit. Set Tx/Rx switch to Rx.

(8) Remove link between T/R and INT TUNER socket on UUT.

(9) Connect cable to RF I/P, O/P connector on TRE and T/R socket on UUT.

NOTE: Voltage breakdown will be indicated by intermittent output indications on the UUT meter.

Receiver sensitivity

34. This check verifies the overall operation of the receiver by checking the AF output level for particular RF input signal levels on each mode.

35. Proceed as follows:

(1) At the UUT set:

CW
2.0000 MHz with RANGE 2 - 3.1
LP
GAIN fully clockwise

(2) At the TRE set DVM FUNCTION switch to AUDIO O/P and DVM range 1.0V ac.

(3) Set the RFG to 2.00000 MHz, 1 uV EMF, CW(W), CARRIER ON.

(4) Check that the DVM reads greater than 0.84V (7 mW into 100 ohms).

(5) Set the UUT to CW(N) and check that the DVM reading is greater than 0.84 V.

(6) Set UUT to AM.

(7) Set the RFG to produce 2.0000 MHz, 5 uV EMF, INT AM, MOD ON, 2 kHz modulation, level 85%. Check that the DVM reads greater than 0.84V minimum.

(8) Set the UUT to SSB. Set RFG 1 uV EMF, CW. Set the UUT to each of the following frequencies in turn. At each step, set the RFG to the same frequency. In each case, check that the DVM reads greater than 0.84V minimum

Frequency	Range
2.0000 MHz	2 - 3.1
2.5000 MHz	2 - 3.1
3.1000 MHz	2 - 3.1
3.1000 MHz	3.1 - 4.9
4.0000 MHz	3.1 - 4.9
4.9000 MHz	3.1 - 4.9
4.9000 MHz	4.9 - 7.7
6.0000 MHz	4.9 - 7.7
7.7000 MHz	4.9 - 7.7
7.7000 MHz	7.7 - 12.2
10.0000 MHz	7.7 - 12.2
12.2000 MHz	7.7 - 12.2
12.2000 MHz	12.2 - 19.1
16.0000 MHz	12.2 - 19.1

Frequency	RANGE
19.1000 MHz	12.2 - 19.1
19.1000 MHz	19.1 - 30
25.0000 MHz	19.1 - 30
29.9990 MHz	19.1 - 30

(10) At UUT set 2.000 MHz with RANGE 2-3.1 LP. At TRE set RFG to 200 uV EMF, 2.0000 MHz, CW.

(11) Check that the DVM reads greater than 0.84V minimum.

(12) Check that movement of the UUT GAIN control smoothly changes the DVM reading and that when the control is fully anti-clockwise, the DVM reads less than 0.02V minimum.

Frequency check facility

36. This test verifies the operation of the frequency check facility. It consists of setting the receiver input to produce a 2 kHz output at the same level as the internal tone and then checking that a beat occurs when the UUT is set to FREQ CHK.

37. Proceed as follows:

(1) At the UUT set:

FREQ CHK
2.0000 MHz with RANGE 2 - 3.1
LP
GAIN fully anti-clockwise

(2) At the TRE set:

DVM FUNCTION switch to AUDIO O/P and DVM range to 1.0V ac.

(3) Check that the DVM reads between 0.3V minimum and 1.35V maximum. Note this reading.

(4) Set the RFG to 2.0000 MHz, 25 uV EMF, CW, CARRIER ON.

(5) Set the UUT to CW(N) and adjust GAIN control to obtain an approximate DVM reading to that obtained in (3).

(6) Set UUT to FREQ CHK. Slowly step the RFG frequency in 10 Hz steps and check that the frequency of beat heard in the loudspeaker increases as the RFG frequency differs from UUT.

Signal + noise/noise ratio

38. This checks the receiver signal + noise/noise ratio on each mode is better than 10 dB.

39. Proceed as follows:

(1) At the UUT set:

CW(W)
25.0000 MHz with RANGE 19.1 - 30.

LP
GAIN fully clockwise

(2) At the TRE set DVM FUNCTION switch to AUDIO O/P and DVM range to 1.0V ac.

(3) Set RFG to 25.0000 MHz, 0.8 uV EMF, CW, MOD OFF, CARRIER ON.

(4) Adjust UUT GAIN control until the DVM reads 0.32V $\pm$ 0.01V

(5) Set RFG switch to CARRIER OFF. Check that DVM reads less than 0.108V maximum. Set RFG switch to CARRIER ON.

(6) Set UUT to CW(N). Repeat (4) and (5), checking that the DVM reads less than 0.047 V maximum.

(7) Set UUT to SSB. Repeat (4) and (5).

(8) Set UUT to AM.

(9) Set RFG to 25.0000 MHz, 5 uV EMF, INT AM, MOD ON, 2 kHz modulation, level 30%. Repeat (4).

(10) Note DVM reading. On RFG switch to MOD OFF. Check that the DVM reads less than 0.108V maximum.

AGC operation

40. This test verifies the operation of the agc by checking the change in level of audio output for a defined change in modulated RF output (AM) or unmodulated input (SSB).

41. Proceed as follows:

(1) At the UUT set:

SSB
2.5000 MHz with RANGE 2 - 3.1
LP
GAIN fully clockwise

(2) At the TRE set DVM FUNCTION switch to AUDIO O/P and DVM range to 1.0V ac.

(3) Set the RFG to 2.5000 MHz, 2 uV EMF, CW, MOD OFF, CARRIER ON.

(4) Adjust the UUT GAIN until the DVM reads 0.32V $\pm$ 0.01V.

(5) Slowly increase the RFG output to 100 mV EMF. Check that the DVM reads 0.31V minimum to 0.57V maximum.

(6) Set UUT to AM.

(7) Set RFG to 2.5000 MHz, 10 uV EMF, INT AM, MOD ON, 2 kHz modulation, level 30%.

(8) Adjust UUT GAIN until the DVM reads 0.32V $\pm$ 0.01V, and repeat step (5).

ALIGNMENT PROCEDURES

Introduction

42. The alignment procedures should be carried out after replacement of a module and are based on the assumption that all other adjustments necessary to ensure its compatibility with the other modules were carried out when it was tested at third line. The performance checks should be carried out in full on completion of adjustment.

Random monitoring

43. The DVM and counter normally display RF or AF as selected by switches on the TRE. The items can be utilised to display the input to a probe connected to any part of the UUT as follows:

(1) DVM - Disconnect internal cable and connect RF or DC/AF probes provided as required.

(2) Counter - Disconnect internal cable and connect probe provided.

Preliminary

CAUTION: Always ensure that power is removed from the unit whilst opening the unit, removing or replacing a module, and while closing the unit.

44. The cover should be removed from the UUT (see assembly/disassembly), the two halves should then be interconnected via the RT320 Test Unit, with the front panel and chassis assembly mounted on the test stand provided with the Test Kit Radio. If access to any of Units 6a to 6e is required, refer to assembly/disassembly and set Unit 6 in the servicing position, similarly for Units 8 and 9.

45. The UUT should be connected as given in para.7, with controls set as given in paras.8 and 9. The RT320 Test Unit TEST SELECT switch should be set to 6 except when stipulated otherwise.

PSU (Unit 5) alignment

46. Remove the screen can from the PSU and the PSU from the chassis.

47. Interpose the Power Supplies Test Unit between the PSU and the remainder of the UUT (i.e. between 1PL4 - 5SK4).

48. At the TRE set:

PSU VOLTS switch to 24V
DVM FUNCTION switch to PSU VOLTS and DVM range to 100V dc
AF OSCILLATOR switch to OFF
Tx/Rx switch to Rx

49. Set the test unit switch to Rx and UUT to LP.

50. Check that the DVM reads 24V $\pm$ 0.02V.

51. Connect the DVM externally using the DC/AF probe to measure the voltage at TP2 on Unit 5b. On Unit 5a adjust 5aR3 until the DVM reads 121V $\pm$ 0.4V.

52. Connect the DVM externally to the MONITOR VOLTAGE terminals on the power supplies test unit. Carry out tests and adjustments in the sequence shown below. Set DVM to the correct d.c. range when carrying out adjustments.

Test unit switch settings		Reading	Adjustment control
12V	Rx	12.6V ± 0.6V	--
6V	Rx	6.0V ± 0.02V	5bR4
3V	Rx	2.9V ± 0.02V	5aR7
110V	Rx	110V ± 0.2V	5bR11
*	Rx	121V ± 0.4V	--
*	Tx	122V ± 1.0V	--
6V OSC	Tx	6.0V ± 0.02V	--

*DVM connected to TP2 (121V) on Unit 5b.

53. Disconnect the test unit, replace the PSU and screening can, and replace the connection between the PSU and UUT.

Unit 2 bias current check

54. Proceed as follows:

(1) Set the UUT to:

CW(W)
2.5000 MHz with RANGE 2 - 3.1
HP
GAIN fully anti-clockwise

(2) Connect current shunt (1 ohm) between RT320 Test Unit MON CURRENT terminals.

(3) Connect the DVM externally, using the DC/AF probe to measure the voltage across MON CURRENT terminals. Set DVM to 100 mV dc or 1V dc as required.

(4) At the TRE set Tx/Rx switch to Tx and set the test unit TEST SELECT to 1, 2 and 3 in turn. At each step, check that the current is within the limits given.

TEST SELECT	LIMITS	Test
1	80 - 125 mV (80 to 125 mA)	24V PA bias
2	0.17 - 0.23 V (170 to 230 mA)	6V PA bias
3	2.5 - 3.5 mV (2.5 to 3.5 mA)	6V reflectometer bias

(5) Set Tx/Rx switch to Rx and reconnect the DVM internally.

(6) Set the TEST SELECT switch to 6.

Driver and PA bias adjustment (Unit 2a)

NOTES: 1. Adjustment is not necessary if complete rear panel assembly is replaced.

2. Remove the reflectometer cover to obtain access to panel 2a PA bias controls.

55. Proceed as follows:

(1) Connect DVM externally using DC/AF probe to MONITOR CURRENT terminals. Set DVM range to 100 mV dc.

(2) Connect current shunt (1 ohm) between RT320 Test Unit MONITOR CURRENT terminals and set TEST SELECT switch to 2.

(3) At UUT set:

CW(W)
HP
Adjust 2aR34 and 2aR43 fully anti-clockwise

(4) At the TRE set Tx/Rx switch to Tx.

(5) Check that the DVM reads 170 to 230 mV (170 to 230 mA). Reset Tx/Rx switch to Rx.

(6) Set TEST SELECT switch to 1.

(7) Set Tx/Rx switch to Tx and check that the DVM reads 17.4 to 50 mV (17.4 to 50 mA).

(8) Adjust 2aR34 to increase DVM reading by 14 $\pm$ 2 mV (14 $\pm$ 2 mA).

(9) Adjust 2aR43 to increase DVM reading by a further 55 $\pm$ 4 mV (55 $\pm$ 4 mA). Check that the meter reads 81 mV minimum to 125 mV maximum (81 to 125 mA).

(10) Set TEST SELECT switch to 6. Set Tx/Rx switch to Rx and reconnect DVM internally.

ALC adjustment (Unit 2a)

NOTE: This adjustment is not necessary if complete rear panel assembly is replaced.

56. Proceed as follows:

(1) At Test Unit, connect RFG OUTPUT to EXT PA DRIVE socket and set TEST SELECT to 5. Connect MON CURRENT terminals together.

(2) Set RFG to 2.5 MHz, 2 uV EMF, CW.

(3) Set DVM FUNCTION switch to UUT CURRENT and DVM range to 1V dc.

(4) Set 2aR2 fully clockwise and set PA Filters to range 1.

(5) Set Tx/Rx switch to Tx.

(6) Increase RFG output until the Power Meter reads 15W $\pm$ 1.5W. Check that the DVM reads 0.16V $\pm$ 0.03V (1.6A $\pm$ 0.3A).

(7) Adjust 2aR2 until the Power Meter reads 10W $\pm$ 1W.

(8) Set PSU VOLTS to 32V, Tx/Rx switch to Tx and read Power Meter immediately. Adjust 2aR2 until Power Meter reads 29W ± 0.5W. It may take several attempts to get setting of 2aR2 correct.

(9) Set TEST SELECT to 6. Set Tx/Rx switch to Rx. Set PSU VOLTS to 24V.

Low level drive levels (Unit 6 adjustments)

57. Proceed as follows:

(1) At the Test Unit set the TEST SELECT switch to 3.

(2) At the UUT set:

CW(W)
LP
2.0000 MHz with RANGE 2 - 3.1

(3) At the TRE:

Set DVM FUNCTION switch to OSCILLATOR O/P
Set DVM range to 1 V a.c.
Set AF OCSCILLATOR switch to T/R MIC HIGH
Adjust VAR 2 kHz control until the DVM reads 0.2 V (20 mV e.m.f.)
Set Tx/Rx switch to Tx.

(4) Set the DVM range to 100 mV d.c., and conect the DVM externally, via the RF Probe to the INT PA DRIVE socket on the test unit.

(5) Note the DVM reading. If the reading is between 14 mV minimum and 33 mV maximum go to step (9). If the reading is either below 14 mV maximum or above 33 mV minimum go to step (6).

(6) At the UUT unit 6e (refer to Fig. 1) remove all existing links between pins 8 to 13 inclusive. Insert the following two links in their place:

Pin 9 to Pin 11
Pin 10 to Pin 12

(7) Note the DVM reading now obtained, and ascertain which pair of limits in the following table it falls between (3rd Column):

TRUE READING (mV)		LINK	DVM READING (mV)	
Min.	Max.		Min	Max
19	27	8 - 10 - 12	4	8
27	40	9 - 10 and 11 - 13	8	15
40	60	9 - 11 and 10 - 12	15	30
60	84	9 - 11 and 8-10-12	30	50
84	110	9 - 11 - 13	50	75

Insert links in UUT unit 6e according to the DVM reading obtained.

(8) Repeat step (5)

(9) Set the UUT to CW(N); adjust R9 in UUT Unit 6d to produce the same reading as noted in step (5) or step (8), according to whether or not steps (6) to (8) were carried out.

(10) Set the UUT to SSB; check that the DVM reads within 13 mV minimum to 50 mV maximum.

(11) At the Test Unit, set the TEST SELECT switch to 6.

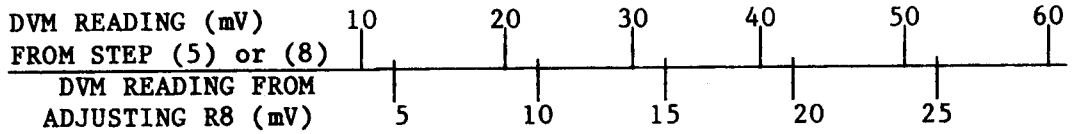
(12) At the TRE, set the Modulation Meter to:
AM, odB, - VE, 100%

(13) At the UUT set AM and 25.0000 MHz with RANGE 19.1 - 30.

(14) At the UUT, adjust R3 in Unit 6d until the Modulation Meter reads 85%.

(15) At the Test Unit, set the TEST SELECT switch to 3.

(16) Set the UUT to 2.0000 MHz with RANGE 2 - 3.1. Adjust R8 in UUT Unit 6d to produce a DVM reading related to the DVM reading obtained in step (5) or (8). The relationship is shown on the scale below.



(17) At the TRE set the Tx/Rx switch to Rx, and re-connect the DVM internally.

Clipping Threshold (Unit 6c)

NOTE: This adjustment is not necessary if units 6c/d are replaced as a coplete unit.

58. Proceeds as follows:

(1) Set the TEST SELECT switch to 3 on RT320 Test Unit.

(2) At the UUT set SSB, 2.5000 MHz with RANGE 2 - 3.1

(3) At the TRE set:

DVM FUNCTION switch to OSCILLATOR O/P and DVM range to 1.0V ac
AF OSCILLATOR to T/R MIC HIGH.

(4) Set Tx/Rx swith to Tx and adjust VAR 2 kHz control until DVM reads 0.12V $\pm$ 0.001V (12 mV emf at UUT).

(5) Connect the DVM externally, using DC/AF probes, to TPG on UUT Unit 6 Note the DVM reading.

(6) Connect the DVM externally, using the RF probe, to INT PA DRIVE socket on RT320 Test Unit.

(7) Set DVM range to 100 mV dc and check that the DVM reads 20 mV minimum to 28 mV maximum (47 mV to 63 mV at UUT).

(8) Connect the DVM externally, using DC/AF probes, to TPG on UUT Unit 6.

(9) Adjust VAR 2 kHz control until the DVM reads 10% (20 dB) of that noted in (5).

(10) Repeat (6).

(11) Set DVM range to 100 mV dc and check that the DVM reads 8 mV minimum to 18 mV maximum (33 mV to 45 mV at UUT).

(12) If necessary, adjust 6cR6 until the DVM reads 11 mV ± 0.1 mV (i.e. 3 dB, 70% of that obtained in (7)).

(13) Set Tx/Rx switch to Rx and reconnect the DVM internally.

AGC adjustments (Unit 6)

59. Proceed as follows:-

(1) Set 6bR2 and 6bR4 anti-clockwise.

(2) At UUT set:

AM
2.0000 MHz with RANGE 2 - 3.1
GAIN fully clockwise

(3) Set RFG to 2.0000 MHz CW and 10 uV output and connect to I/P Rx socket on RT320 Test Unit with TEST SELECT switch set to 6.

(4) Connect DVM externally, using RF probe, to TPh on 6a, and set the DVM to the 100 mV d.c range.

(5) Adjust 6aL2 and 6aL3 for maximum reading on DVM. Check that the DVM reads 230 mV minimum to 550 mV maximum.

(6) If the DVM reading is not between the two readings obtained in (5) above, remove the links at unit 6a, note the DVM reading and replace links as indicated in the table below.

True Reading (mV at UUT)	Link	DVM Reading (mV) Min.	Max.
32 to 62	6 to 9	15	32
62 to 88	6 to 8	32	54
88 to 120	6 to 9	54	85
120 to 200	7 to 10	85	190
200 to 250	6 to 10	190	250
250 to 500	NONE	250	500

(7) Repeat (5), (6) as necessary

(8) Connect DVM internally, set DVM FUNCTION switch to AUDIO O/P and DVM range to 1.0V ac.

(9) Set UUT to SSB and RFG to 2.0000 MHz, 1 uV EMF, CARRIER ON, MOD OFF.

(10) Adjust 6bR5 for DVM reading 1V ± 0.01V.

(11) Set RFG level to 2 uV EMF and adjust UUT GAIN control until the DVM reads 0.32V ± 0.01V.

(12) Adjust 6bR4 until the DVM reads 0.225v ± 0.01V.

(13) Adjust UUT GAIN control until the DVM reads 0.32V ± 0.01V.

(14) Set RFG level to 100 mV EMF and check that the DVM reads 0.32V minimum to 0.92V maximum (i.e less that 5 dB change in output).

(15) Set UUT to AM, GAIN fully clockwise.

(16) Set RFG to 2.0000 MHz AM, modulated 1 kHz at 85%, level of 5 uV EMF, CARRIER ON, MOD ON.

(17) Set UUT GAIN control fully clockwise and adjust 6bR11 until the DVM reads 1V ± 0.01V.

(18) Set RFG level of 10 uV EMF and adjust UUT GAIN control until the DVM reads 0.32V ± 0.01V.

(19) Adjust 6bR2 until the DVM reads 0.225V ± 0.01V.

(20) Set RFG modulation level to 30%.

(21) Adjust UUT GAIN control until the DVM reads 0.32V ± 0.01V and repeat (14).

Battery voltage indication

60. Proceed as follows:

(1) At the UUT set:

CW(W)
2.5000 MHz with RANGE 2 - 3.1
BATT CHK
GAIN fully anti-clockwise.

(2) At the TRE set:
DVM FUNCTION switch to PSU VOLTS and set DVM range to 100V dc
PSU VOLTS switch to 16-32V

(3) At the TRE, adjust VAR SUPPLY control until the DVM reads 20V ± 0.1V

(4) If necessary, adjust R4 on Unit 6 until the UUT meter indication is exactly on the first mark from zero (i.e. 20% FSD).

Oscillator alignment (Unit 3)

61. After replacing any part of Unit 3 (but not Unit 3 complete), and before fitting the unit screens and Unit 4, proceed as follows:

(1) At the TRE set DVM FUNCTION switch to AUDIO O/P and set DVM range to 100V dc.

(2) Connect DVM externally using the DC/AF probe to measure voltage at TPq on Unit 3a (monitor varicap diode voltage).

(3) Set UUT to CW(W) and to each of the FREQUENCY settings in turn at each step, refer to Table 1 and

(a) Set UUT frequency to the upper tracking frequency given, adjust the indicated capacitor for the specified varicap diode voltage.

(b) Set the UUT frequency to the lower tracking frequency given and adjust the indicated inductor for the specified varicap diode voltage.

(c) Repeat (a) and (b) until no further adjustment is necessary.

Table 1
Oscillator tracking

TRACKING FREQUENCY RANGE	UUT FREQUENCY MHz	ADJUST	VARICAP DIODE VOLTAGE
2 - 3.1	2.990	3jC1	61.30V ± 0.5V
	2.110	3jL1	9.67V ± 0.05V
3.1 - 4.9	4.720	3kC1	60.80V ± 0.5V
	3.280	3kL1	8.86V ± 0.05V
4.9 - 7.7	7.420	31C1	61.00V ± 0.5V
	5.180	31L1	9.10V ± 0.05V
7.7 - 12.2	11.750	3mC1	60.80V ± 0.5V
	8.150	3mL1	8.77V ± 0.05V
12.2 - 19.1	18.410	3nC1	61.00V ± 0.5V
	12.890	3nL1	9.25V ± 0.05V
19.1 - 30	28.910	3pC1	61.00V ± 0.5V
	20.190	3pL1	9.12V ± 0.05V

Table 2
RF tuned circuit tracking

FREQUENCY RANGE	FREQUENCY MHz	ADJUST at unit
2 - 3.1	2.990	3b
	2.110	
3.1 - 4.9	4.720	3c
	3.280	
4.9 - 7.7	7.420	3d
	5.180	
7.7 - 12.2	11.750	3e
	8.150	
12.2 - 19.1	18.410	3f
	12.890	
19.1 - 30	28.910	3g
	20.190	

(4) Disconnect DVM probe from TPq and connect DVM internally and set DVM range to 1.0V ac.

(5) Disconnect agc link at Unit 6 TPF.

(6) At the Test Unit, connect RF generator to RxI/P socket and set TEST SELECT to 4.

(7) Set UUT to each of the frequency range settings in turn. At each step, refer to the list below and repeat (a) and (b) until no further step is necessary.

(a) Set the UUT to the upper tracking frequency. Set the RFG to this frequency. At the given unit, adjust the capacitors C3, C2 and C1 in that order, for maximum reading on the DVM. (Adjust RFG level to keep reading below 1V).

(b) Set UUT to lower tracking frequency. Set RFG to this frequency. At the given Unit, adjust the three incidators L3, L2, L1 in that order, for maximum reading on the DVM. (Adjust RFG level to keep DVM reading below 1V).

(8) With UUT and RFG appropriately set for highest upper tracking frequency, adjust 3aL2 or maximum reading on DVM.

(9) Replace link at TPF.

Reference oscillator

62. Proceed as follows:

(1) At the UUT set:

CW(W)
25.0000 MHz with RANGE 19.1 - 30
LP

(2) At the TRE set AF OSCILLATOR switch to OFF, Tx/Rx switch to Rx and wait 10 minutes.

(3) Using the DVM, with RF probe and counter externally connected check that:

(a) At Unit 8 pin 8, the frequency is 1.75 MHz $\pm$ 0.0875 Hz averaged over a period of 10 seconds and that the DVM reading is between 0.34 and 1.30V (DVM set to 10V dc range).

(b) At Unit 8 pin 5, the frequency is 1.75 MHz $\pm$ 0.0875 Hz averaged over a period of 10 secs. Set DVM range to 100 mV and connect DVM with RF probe to RFG. Set RFG to 1.75 MHz CW 80 mV EMF. Note reading on DVM. Set RFG to 120 mV EMF and note reading on DVM.

(c) Connect DVM with RF probe to Unit 8 pin 5 and ensure DVM reading is within those noted above.

(d) Repeat (b) for USB and LSB.

(4) With the DVM externally connected to Unit 8 pin 3, using the DC/AF probe, check that the DVM reads OV for CW, USB, LSB.

(5) At UUT set AM and check that the DVM reading is greater than 1.7V minimum.

(6) With the DVM externally connected to Unit 8 pin 5, using the RF probe, repeat (5) and check that the DVM reading is less than 1 mV.

(7) At UUT set CW(W) and offset range switch to cause loss of lock. Check that DVM reading changes from that measured in (3)(b) to less than 1 mV.
(8) With the DVM externally connected to Unit 8 pin 3, using the DC/AF probe, repeat (7) and check that the DVM reading changes from OV to greater than 1.0V minimum.

VHF filter attenuation

63. This test checks that a constant emf of 1V applied to the VHF filter will provide an output level between 33 MHz and 100 MHz of greater than 24 dB below that at 30 MHz.

NOTE: This test cannot be carried out on an open unit.

64. Proceed as follows:

(1) Fit coupler, dummy antenna (part of Test Kit Radio) to UUT whip antenna outlet. Connect RFG to UUT INT TUNER socket. Connect 50 ohm load to coupler.

(2) Connect the DVM externally, using the RF probe to 50 ohm load. Set DVM range to 1.0V dc.

(3) Set the RFG output to 30 MHz, CW, 100 mV EMF, CARRIER ON.

(4) At the UUT, adjust the antenna load and tuning controls for maximum output on the DVM.

(5) Note this indication.

(6) Set the RFG to 40, 50, 60, 70, 80, 90 and 100 MHz, at 1585 mV EMF, in turn. At each step check that the DVM reads less than that noted in (5).

(7) At the TRE reconnect T/R RF I/P O/P socket to UUT T/R socket.

65. The UUT should now be dried, closed and tested for sealing and leakage by raising the internal pressure of the unit to 5 p.s.i (0.35 kg/cm^2 or 0.35 bar) and checking for any leaks. (The first paragraph of REPAIR procedure refers).

FAULT FINDING

66. If an unsatisfactory result is obtained on any performance check, a fault condition must be suspected. The alignment procedures can be used as checks (i.e. without adjustment) to provide additional diagnostic information. In any case, further diagnostic information can be obtained by monitoring various points within the UUT, utilising the checks given below.

NOTE: It is recommended that performance checks not be abandoned with the first incorrect result. All the results for a particular test, previous tests and selected later tests will provide diagnostic information.

67. The following paragraphs are intended to aid diagnosis of a faulty module. They suggest possible fault locations and should be used in conjunction with the diagrams in Section 2.

Preliminary

68. The UUT should be open and connected as specified in para.44. It should be connected to the TRE as given in para.7, with controls set as given in paras.8, 9 and 45.

NOTES: 1. Refer to para.43 for use of TRE in monitoring points within the UUT.

2. All r.f. measurements quoted into 50 ohms.

Test points

69. Test points are identified by a single white ring around a pin on a panel electronic circuit or assembly screening can. Each has an identification code consisting of an upper case letter (active in the transmit condition) or a lower case letter (active in the receive condition). Other pins, which are numbered, are used for interconnections.

Current consumption

70. Check the PSU alignment (paragraphs 46 to 53). A faulty PSU may appear to give the correct voltage regulation but at the same time draw excessive current, particularly at temperature extremes.

71. Typical current levels are listed in the following table. (No R.F. signal applied on receive, no A.F. signal applied on transmit).

72. Connect 1 ohm load to DVM and DVM externally using DC/AF probe to each Test Point as indicated in Table 3. Note: 10 mV = 10 mA.

Table 3
Typical current levels

Module	Pin Number	Description	Current (mA)
1a	5	3V	5
2a	Use Test Set Radio	6V Tx	230
	Use Test Set Radio	24V Tx	80
2b	Use Test Set Radio	6V Tx	3.5
	17	24V Sw.(on Tx)	28
3a	8	6V Tx	30
	1	24V Tx	28
3h	1	6V	35
6a	4	6V Rx	11
6b	14	6V	26
	9	6V Rx	2.5
6c	21	6V Tx	80
	9	6V (on Tx)	12
	9	6V (on Tx)	4.5
6e	4	6V Tx	48
8	7	12V	25
9	2	3V	450
	36	6V	32
	15	110V	7

Transmitted frequency accuracy

73. Ensure that an error is not due to the synthesiser logic, by completing the synthesiser logic tests detailed in para.15.

Synthesiser logic

74. If the frequency is unstable first try a replacement unit 5 and then unit 8. If the fault persists either unit 9 or unit 3 is suspect.

75. At TPq of Unit 3h, disconnect the wire lead from the synthesiser, connect a 0-110V supply to TPq, refer to Table 1 and, for a given UUT FREQUENCY RANGE and FREQUENCY setting, adjust the 0-110V supply to provide the given varicap diode voltage. If phase lock is not achieved, unit 3 is suspect, otherwise unit 9 is suspect. Remove the 0-110V supply and reconnect wire lead to TPq.

76. If a unit 9 fault is suspect, refer to Table 4 and, using DVM (and appropriate probe) externally connected to each pin designated, check the voltage levels for each setting of the appropriate UUT switch. Similarly, check the levels at pins as given in Table 5.

Transmitter output power (CW)

77. If the output power is low, check that the 24V supply is correct. A failure of some of the frequency ranges indicates that the fault is within units 3b to 3g or units 2c to 2f. The successful completion of tests detailed in paras.34 and 57 will confirm that units 2 or 3 are faulty. Typical transmit voltage levels measured with DVM and appropriate probe are listed in Table6 (an A.F. input of 2 kHz at 40 mV to the UUT is used for levels on AM and SSB i.e. 400 mV indicated by DVM when DVM function switch set to OSC O/P).

Transmitter mean power output and modulation depth (AM)

78. The comments and table of levels in para.77 apply. Should the modulation depth be incorrect, complete the unit 6 adjustments (para.57) and clipping threshold alignment (para.58).

Phase lock indication

79. If the tone is only present on some frequency ranges, check units 3j - 3p for dirty contacts and try the oscillator alignment procedure detailed in para.61. Should the tone be present on all frequency ranges, it may be due to a failure of the 110V supply in Unit 5. Follow the procedure detailed in paras.46-53.

Sidetone level

80. If the sidetone level is incorrect, measure at TPE to isolate the fault to Unit 6b or Unit 6c and 6d (see para.77).

Antenna tuning

81. Before replacing a suspect Unit 4, check that the coax link from 2SK7 to 2SK8 is made and that Unit 2 is functioning correctly, (para.18).

Receiver sensitivity

82. If Unit 3 is suspect i.e. the sensitivity is low on some ranges, clean the contacts of Units 3b - 3g and follow the alignment procedure detailed in paras.59 and 61.

Table 4
Frequency setting switch code

Unit 9 Pin	Signals applied in Switch Position 0	1	2	3	4	5	6	7	8	9	Switch
9	+	0	+								
23	0	+	+								10MHz
25	0	+	0	+	0	+	0	+	0	+	
24	0	0	0	0	+	+	0	0	+	+	
7	0	0	0	0	0	0	+	+	+	+	1MHz
8	0	0	+	+	+	+	+	+	+	+	
28	+	0	+	0	+	0	+	0	+	0	
27	0	+	+	0	0	0	0	+	+	0	
5	+	+	+	0	0	0	0	0	0	+	100kHz
6	+	+	+	0	0	+	+	+	+	+	
26	0	0	+	+	+	+	+	+	+	+	
31	0	+	0	+	0	+	0	+	0	+	
30	+	+	0	0	+	+	0	0	0	0	
3	0	0	+	+	+	+	0	0	0	0	10kHz
4	+	+	+	+	+	+	0	0	+	+	
29	0	0	0	0	0	+	+	+	+	1	
33	+	0	+	0	+	0	+	0	+	0	
32	+	0	0	0	0	+	+	0	0	+	
37	+	0	0	0	0	0	0	+	+	+	1kHz
1	+	0	0	+	+	+	+	+	+	+	
22	0	+	0	+	0	+	0	+	0	+	
10	0	+	+	+	+	0	+	+	+	+	
12	+	0	0	+	+	+	+	+	0	0	
21	0	+	+	+	0	0	+	0	0	0	100Hz
11	0	+	+	+	+	+	+	+	+	+	

+ indicates nominal 3V
0 indicates open-circuit

NOTE: PIN 2 is 0 in CW(W), CW(N) and SSB modes
PIN 2 is + in AM Mode (no sidestep)

Table 5
Synthesiser - typical output levels

Unit and Pin No.	DVM Reading (V)	Remarks
9b, 13	0.530	2 kHz
9b, 18	0.530	1.75 MHz
9b, 38	0.370	(fi + 1.75 MHz)

Table 6
Typical test data - transmitter

Test Points	DVM Reading (V)	Remarks	Mode
TPA	0.01	2 kHz	AM, SSB
TPB	0.01	2 kHz	AM, SSB
TPC	Less than 1V d.c.		All modes
TPD	0.065	2 kHz	All modes
TPE	0.21	2 kHz clipped	CW(W) & CW(N)
TPE	0.22	2 kHz clipped	AM, SSB
TPF	0.065	1.75 MHz	All modes
TPG	0.1	2 kHz	AM, SSB
TPH	0.1	2 kHz	AM, SSB
TPJ	0.2	IF + sidebands, clipped	AM
TPJ	0.4	IF + sidebands, clipped	SSB
TPJ	0.4	IF + sidebands, clipped	CW(W) & CW(N)
TPK	0.15	IF (1748kHz)	CW(W) & CW(N)
TPK	0.15	IF (1748kHz)	SSB
TPK	0.08	IF (1750kHz)	AM
TPL	0.02	fo + 1.75 MHz	AM
TPL	0.02	fo + 1.748 MHz	SSB,CW(W),CW(N)
TPM	0.02	RF + sidebands	CW(W)& CW(N)
TPN	0.02	RF	CW(W) & CW(N)
TPT	0.15	RF	CW(W) & CW(N)
TPU	7.00*	RF	CW(W) & CW(N)

*Use UUT set to LP to avoid damage to RF probe

Before replacing Units 6c and 6d check the levels given in the following table:

Unit & Pin No.		Level	Remarks	Mode
6c	5	0V d.c.		All modes
6c	8	2.5V d.c.		All modes
6c	15	6V d.c.		CW
6c	18	6V d.c.		SSB

83. Typical receiver levels measured with DVM and appropriate probe are given in Table 7. The UUT shall be set to 2 MHz and 85% modulation at 2 kHz applied as necessary. Set RFG to frequency of UUT. Levels at other frequencies may be higher. Disconnect the link at TPf Unit 6.

Signal + noise/noise ratio

84. The comments in paras.82, 83 apply.

AGC operation

85. See paragraph 83.

Table 7
Typical test data - receiver

RFG level e.m.f.	Test Point	DVM Reading (V)	Remarks	Mode
100 mV	TPa	0.02	RF	All modes
10 mV	TPb	0.006	RF	All modes
10 mV	TPc	0.006	RF	All modes
-	TPd	0.065	IF + RF	All modes
1 mV	TPe	0.01	IF	
1 uV	TPf	+1V d.c.	)Link at TPf	All modes
100 mV	TPf	+4Vd.c.	)Unit 6 connected	All modes
1 mV	TPJ	0.008	IF	All modes
1 uV	TPh	0.015	IF	AM
1 uV	TPh	+1.3	dc	AM
1 uV	TPh	0.07	IF and 1.75 MHz	CW, SSB
1 uV	TPh	+1.3	dc	CW, SSB
1 uV	TPm	0.18	AF	CW, SSB
5 uV, 85% Mod.	TPm	0.18	AF	AM
1 uV	TPn	1.0	AF	CW, SSB
5 uV, 85% Mod.	TPn	1.0	AF	AM
-	TPL	0.02	fo + 1.750	AM
-	TPL	0.02	fo + 1.748	SSB, CW

Before replacing Unit 6b, check the following:

RFG level e.m.f.	Pin No.	Level	Remarks	Mode
-	2	0.2V d.c.		All modes
-	6	0V		CW, SSB
-	6	6V d.c.		AM
See TPf above	7		As TPf	AM
-	8	40 mV	1.75 MHz	
See TPf above	11		As TPf	CW, SSB
*	13	0.18V	A.F. (As TPm)	All modes
-	14	6V d.c.	As TPd	All modes
-	16	0V		CW, SSB
-	16	2V d.c.		AM

*5 uV 85% mod. on AM, 1 uV CW on all other modes.

NOTE: In Table 7, the term CW covers both CW(W) and CW(N) modes.

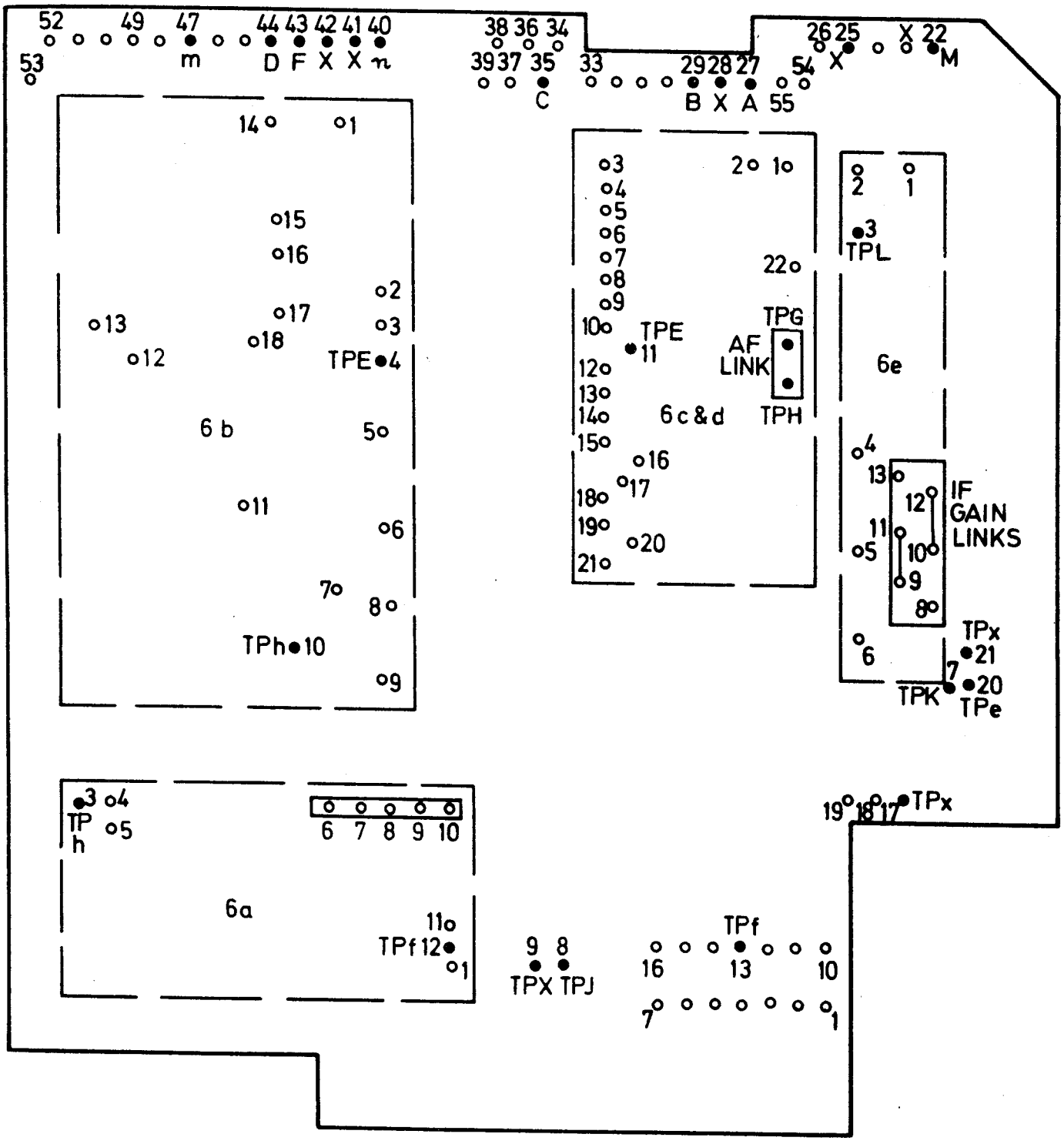


Fig.1 Unit 6 – terminal pin and test point locations

DISMANTLING AND ASSEMBLY

OF

MANPACK RECEIVER-TRANSMITTER

RT320 SERIES

CONTENTS

	Para.
Introduction	1
Removal/replacement of case	3
Rear panel assembly - connector alignment	5
Front panel assembly - frame alignment	7
Tuner unit (Unit 4)	9
Turret assembly (Unit 3)	11
Power supply assembly	13
AF and IF panel assembly (Unit 6)	15
Elapsed time indicator replacement	20
Units 6a to 6e	21
Filters 1FL1 and 1FL3	23
Filter 1FL2	24
Reference oscillator assembly (Unit 8)	25
Filter (Unit 1a)	27
Synthesiser assembly (Unit 9)	29
PA filter assembly	31
PA filter sub-assembly	33
Reflectometer (Unit 2b)	35
Power amplifier panel (Unit 2a)	37
VHF filter (Unit 2h)	39
Audio decoupler (Unit 2g)	41
Front panel components	43
Components mounted in case	46
Battery spring clips	48

APPENDIX

Cableform connections

WARNING: THE RF POWER TRANSISTORS IN UNIT 2a CONTAIN BERYLLIUM OXIDE MATERIAL WHICH, IF IMPROPERLY HANDLED, CAN CONSTITUTE A SERIOUS HAZARD TO HEALTH. REFER TO HEALTH HAZARD NOTICE AT THE BEGINNING OF THIS MANUAL.

Introduction

1. The procedures given in this section detail the steps necessary to remove and replace the sub-assemblies and certain discrete components of the receiver-transmitter.

2. All orientation i.e. top, bottom, left, right etc refer to the equipment when viewed with the front panel upright and facing the maintainer. For location of the various sub-assemblies, refer to the diagram in the section for second line servicing of the radio.

CAUTION: EXCESS HEAT CAN DAMAGE INSULATION, COMPONENTS ETC. ALL SOLDERING AND UNSOLDERING OPERATIONS SHOULD BE CARRIED OUT WITH A HEAT CONTROLLED IRON SET AT 325°C + 25°C AND THE HEAT SHOULD NOT BE APPLIED FOR A PERIOD IN EXCESS OF $\overline{5}$ SECONDS. A TOOL WHICH REMOVES EXCESS SOLDER MUST BE EMPLOYED.

NOTES: 1. A tool for removing and replacing coaxial inserts in the connectors between the front and rear panels, is provided with the Test Kit Radio 6625-99-622-5100.

2. A tool for removing knobs from the front panel, is provided with the Test Kit Radio 6625-99-622-5100. This tool can also be used to extract the inner moulding from those knobs which have such mouldings.

Removal/replacement of case

CAUTION: DAMAGE TO THE EQUIPMENT CAN RESULT IF THE SEQUENCE GIVEN BELOW IS NOT STRICTLY OBSERVED DURING REMOVAL AND RELACEMENT OF THE CASE.

3. To obtain access to the interior of the unit the case must be removed as follows:

(1) Remove the fourteen socket head cap screws securing the rear panel assembly to the case.

(2) Ease the rear panel assembly from the case, ensuring that the gasket is not damaged.

(3) Remove the fourteen socket head cap screws securing the front panel assembly to the case.

(4) Ease the front panel assembly from the case, ensuring that the gasket is not damaged.

4. To refit the cover, proceed as follows:

(1) Examine each gasket for damage or deterioration, replace if necessary.

(2) Lightly coat both surfaces of each gasket with grease XG271.

(3) Set the range switch on the front panel and on the rear panel both to the range 1 (2 - 3.1) position.

(4) With the gasket correctly positioned, fit the front panel into the case. Fit and tighten the fourteen socket head cap screws.

CAUTION: TO AVOID DAMAGE TO THE SHROUDS OF THE INTERNAL MULTIWAY CONNECTORS, IT IS ESSENTIAL THAT UNDUE FORCE BE AVOIDED WHEN FITTING THE REAR PANEL ASSEMBLY. IF THE CASE WILL NOT CLOSE, THE CONNECTORS MAY BE OUT OF ALIGNMENT; THE ALIGNMENT PROCEDURES FOR BOTH FRONT AND REAR PANEL ASSEMBLIES MUST THEN BE CARRIED OUT (PARAS.5 TO 8 INC. REFER).

(5) With the gasket correctly positioned, gently fit the rear panel assembly into the case, ensuring that the internal multi-way connectors mate correctly.

(6) Fit and tighten the fourteen socket head cap screws.

(7) Pressure test the unit as specified in the test procedures.

Rear panel assembly - connector alignment

5. The alignment is carried out with the aid of an alignment jig 6625-99-630-6101 (Plessey Part No.640-4-15433). This jig is either available as a separate item or as a component part of the Test Kit Radio 6625-99-622-5100.

6. With the rear panel assembly removed from the case, proceed as follows:

(1) Loosen the four screws securing the PA filter switch housing to the rear panel casting.

(2) Withdraw the knurled plunger on the jig to its limit.

(3) Place the jig into position over the assembly, ensuring that the following locating points are established:

(a) Fork on jig fitting over shaft of PA filter switch.

(b) Spigot on panel fits into hold on jig.

(c) Spigot on jig fits into appropriate rear panel fixing hole.

(4) Gently lower the knurled plunger, rotating the PA filter switch housing as necessary, until the plunger is a sliding fit over the thin spigot on the PA filter switch housing.

(5) Tighten the four screws securing the PA filter switch housing to the rear panel.

(6) Remove the jig.

Front panel assembly - frame alignment

7. This alignment is carried out with the aid of an alignment jig 6625-99-630-6102 (Plessey Part No.640-4-15432). This jig is either available as a separate item or as a component part of the Test Kit Radio 6625-99-622-5100.

8. With the rear panel assembly removed from the case, proceed as follows:

NOTE: It is not necessary to disturb the screws which secure the main frame to the front panel casting if the turret assembly only has been removed.

(1) Loosen the three pan head screws securing the main frame to the front panel casting. Loosen the four screws which secure the turret to the front panel.

(2) Loosen the three pan head screws securing the turret triangular mounting bracket to the turret assembly and main frame.

(3) Ensure that the two spring loaded retaining clamps on the jig are open.

(4) Ensure that the three dowel locating pins on the jig are in the fully out position.

(5) Fit the front panel assembly into the alignment jig.

(6) Release the spring loaded dowel locating pin to locate with the appropriate front panel screw hole (near the battery studs).

(7) Gently depress the knurled plunger (above turret) until its pin enters the hole adjacent to 2PL1.

(8) Gently depress the second knurled plunger until its pin enters the hole in the socket bracket.

(9) Release the two spring loaded retaining clamps to secure the jig to the set.

(10) Stand the jig on its three support pillars, the chassis will now drop into the two pegs on the jig (close to 2PL1).

(11) Tighten the three screws securing the chassis to the front panel.

(12) Invert the jig and ensure that the sliding gauge pin for checking the chassis height is flush with the raised bush in one of its two halves.

(13) Tighten the three pan head screws securing the turret triangular bracket and the four screws which secure the turret to the front panel.

(14) Remove the jig.

Tuner unit (Unit 4)

9. The tuner unit should be removed as follows:

(1) Remove the case (para.3).

(2) Set the TUNE control to its fully anticlockwise position.

(3) Remove the knob from the RANGE switch and remove the locking nut and washer which secure the switch spindle to the front panel.

(4) At pin 10 of the LOAD switch, unsolder the wire lead which runs to the RANGE switch.

(5) Remove the four pan head screws and crinkle washers which secure the tuner unit to the mounting pillars and gently withdraw the assembly. Ensure that the rubber sealing ring for the switch body is not mislaid.

10. Replace the tuner unit by reversing the above sequence. Note that the tune control should be set fully anticlockwise and the cores of the inductors should be as far as possible towards the front panel before engaging the tune control spindle with the keyway on the tuning shaft.

Turret assembly (Unit 3)

11. The complete turret assembly should not be removed unless necessary. The individual Units 3a to 3p can each be removed whilst the turret assembly remains attached to the radio. Proceed as follows:

(1) In all instances:

(a) Remove the case (para.3).

(b) Remove the tuner (para.9).

(c) Remove the six cheese head screws and crinkle washers securing the left screen to the turret assembly and remove the screen.

(d) Proceed with (2) or (3) or (4) as appropriate.

(2) To remove Unit 3a or 3h:

(a) Unsolder the cableform wire leads from the terminals of the unit to be removed (refer to Table 1 of the appendix to this section).

(b) Set the turret switch to a position between ranges and remove the four screws and crinkle washers that secure the panel and connector block to the assembly.

(c) Remove the Unit (3a or 3h).

(3) To remove any of Units 3b to 3g or 3j to 3p:

(a) Set the turret switch one position clockwise to that which selects the relevant unit.

(b) Remove the two cheese head screws and crinkle washers that secure the unit to the assembly.

(c) Remove the unit.

(4) To completely remove the turret assembly:

(a) Unsolder the cableform wire leads from Units 3a and 3h (refer to Table 1 of the appendix to this section).

(b) Remove the two screws that secure connector 1SK1 to the turret assembly.

(c) Remove the screws and washer securing cableform clamps to the turret assembly.

(d) Remove the pan head screw and crinkle washer securing the triangular mounting bracket to the main frame at the rear of the turret assembly.

(e) Remove the four screws securing the turret assembly to the front panel.

(f) Carefully withdraw the assembly, guiding the cableform wire leads through the apertures.

12. Assemble in the reverse order. When passing the cableform wire leads back through the apertures, ensure that the grommets are inserted into the apertures. Ensure that the adaptor plate between the front panel shaft assembly and turret shaft are correctly aligned and seated. The front panel and chassis assembly must be aligned (para.4) after replacing the complete turret assembly.

Power supply assembly (Unit 5)

13. Remove Unit 5 as follows:

(1) Remove the case (para.3).

(2) Disconnect the 7-way connector to Unit 5.

(3) Remove the two pan head screws securing the cover of Unit 5 to the main frame and withdraw the cover.

(4) Remove the two countersunk head screws securing the electronic circuit panels to the main frame and withdraw the unit.

14. Refit Unit 5 using the reverse sequence to that in para.13.

AF and IF panel assembly (Unit 6)

15. The AF and IF panel assembly is located at the bottom of the front panel assembly and may be mounted in a servicing position for testing and tuning. The servicing position is also used to facilitate the removal and replacement of other units mounted on the front panel assembly.

16. To mount Unit 6 into the servicing position proceed as follows:

(1) Remove the case (para.3).

(2) Remove the two pan head screws securing the socket bracket to the synthesiser sub-frame.

(3) Remove the two pan head screws securing the socket bracket to the main frame.

(4) Remove the seven cheese head screws and crinkle washers, indicated by green circles, securing Unit 6 to the main frame.

(5) Open the unit and fold back on an axis with the adjacent cableform.

(6) Locate the two holes in the mother panel (Unit 6) and secure the mother panel to the main frame using two of the cheese head screws and crinkle washers removed in (4).

17. Reposition Unit 6 to the normal operating position as follows:

(1) Remove the two cheese head screws and crinkle washers securing the mother panel to the main frame.

(2) Fold Unit 6 into the normal position on the main frame and refit the seven cheese head screws and crinkle washers.

(3) Refit the two pan head screws securing the socket bracket to the main frame.

(4) Refit the two pan head screws securing the socket bracket to the synthesiser sub-frame.

(5) Refit the front panel assembly into the case (para.4).

18. Remove Unit 6 as follows:

(1) Mount the unit in the servicing position (para.16).

(2) Remove the two screws securing the socket bracket to the mother panel.

(3) Locate and unsolder the cableform wire leads from the terminals listed in table 2 of the appendix to this section.

(4) Remove the two screws and crinkle washers securing Unit 6 in the servicing position and withdraw the unit.

19. Refit Unit 6 using the reverse of the above sequence.

Elapsed time indicator replacement

20. The elapsed time indicator is replaced as follows:

(1) Mount Unit 6 into the servicing position (para.16).

(2) Unclip the old elapsed time indicator from the mounting.

(3) Clip the new elapsed time indicator in position ensuring that it is correctly polarised. i.e. with the red + signs on the end closest to Unit 6b.

(4) Return Unit 6 into the normal operating position (para.17).

(5) Record the old elapsed time.

Units 6a to 6e

21. To remove any of the Screen and Can Assemblies, Units 6a, 6b, 6c/d or 6e from the mother panel (Unit 6), proceed as follows:

(1) Mount Unit 6 into the servicing position (para.16).

(2) Locate and unsolder the through terminals between the can assembly and the mother panel.

(3) Remove the three nuts and washers securing the case to the mother panel.

(4) Remove the can assembly.

22. When replacing the assembly, ensure that any spacers used are replaced.

Filters 1FL1 and 1FL3

23. To replace either filter 1FL1 or 1FL3, proceed as follows (for radios equipped with only 2 filters ignore references to filter 1FL3):

(1) Mount Unit 6 into the servicing position (para.16).

(2) Disconnect the two wire leads from 1FL1. Similarly disconnect the two wire leads from 1FL3, (refer to table 7 of appendix to this section).

(3) Remove the two nuts and crinkle washers securing the two filters to the main frame and remove both filters.

(4) Discard the faulty filter and obtain a replacement.

(5) Position the two filters in the correct location on the main frame and secure with the two nuts and washers.

(6) Solder the wire leads disconnected in sub-para.(2).

(7) Return Unit 6 to the normal operating position (para.17).

Filter 1FL2

24. Replace filter 1FL2 as follows:

(1) Mount Unit 6 into the servicing position (para.16).

(2) Disconnect the two wire leads from the filter (refer to table 7 of appendix to this section).

(3) Remove the two nuts and crinkle washers securing the filter assembly to the main frame and remove the filter.

(4) Secure the replacement filter in position on the main frame using two nuts and one crinkle washer.

(5) Solder the wire leads disconnected in sub-para.(2).

(6) Return Unit 6 to the normal operating position (para.17).

Reference oscillator assembly (Unit 8)

25. Remove Unit 8 as follows:

(1) Remove power supply assembly (Unit 5) (para.13).

(2) Locate and unsolder the cableform wire leads from the terminals listed in table 3 of the appendix to this section.

(3) Remove the nuts and crinkle washers securing Unit 8 to the synthesiser sub-frame. (The cableform will have to be gently moved away from the lower fixing stud to gain access to the nut). Withdraw Unit 8.

26. Fit Unit 8 using the reverse of the above sequence.

Filter (Unit 1a)

27. Remove Unit 1a as follows:

(1) Remove the front panel assembly from the case (para.3).

(2) Locate and unsolder the cableform wire leads from the terminals listed in table 4 of the appendix to this section.

(3) Remove the two screws securing Unit 1a to the main frame. Withdraw Unit 1a.

28. Fit Unit 1a using the reverse of the above sequence.

Synthesiser assembly (Unit 9)

29. Remove Unit 9 as follows:

(1) Remove the four pan head screws and crinkle washers indicated by green circles, securing the synthesiser sub-frame to the main frame.

(2) Remove two pan head screws and crinkle washers securing the synthesiser fixing bracket to the main frame.

(3) Transfer the synthesiser sub-frame to the arrowed position indicated on the unit.

(4) Locate two holes in the main frame, indicated by green circles, and secure the sub-frame in this position with two screws.

(5) Withdraw the synthesiser sub-frame as far as the cableform will allow.

(6) Locate and unsolder the cableform wire leads from the terminals listed in table 5 of the appendix to this section.

(7) Remove the four special M3 nuts and washers securing the synthesiser assembly to the synthesiser sub-frame and withdraw the unit.

NOTE: Before fitting a replacement synthesiser transfer the synthesiser fixing bracket from the old unit to the replacement unit. The nuts securing the bracket to the synthesiser must be tightened to a torque of 2.25 $\pm$ 0.25 lb.inches. Do not remove the screening can under any circumstances.

30. Fit Unit 9 using the reverse of the above sequence.

PA filter assembly

31. Remove the assembly as follows:

(1) Remove the rear panel assembly from the case (para.3).

(2) Remove the two cheese head screws and crinkle washers securing the side screen to the assembly and remove the screen.

(3) Detach socket A2, complete with connecting wire, from connector 2PL1.

(4) Remove the three cheese head screws and crinkle washers securing the large screen to the assembly. Remove the two pan head screws and washers securing 2PL2 to the assembly and remove the screen.

(5) Remove the two special screws and 3 mm crinkle washers securing the left-hand side of the assembly (i.e. side with 2PL1) to the rear panel.

(6) Remove the two cheese head screws and crinkle washers securing the right-hand side of the assembly to the rear panel.

(7) Gently, so as to avoid damage to interconnecting leads, lift the assembly and move it so as to gain access to the PA board terminals.

(8) With reference to Table 8 in the appendix to this section, unsolder the wire leads at terminals 3, 9, 10, 13, 14, 15, 16 of the PA board. Unsolder the wire lead at socket 2SK7.

(9) Remove the assembly.

32. Replace the assembly as follows:

(1) Position the assembly in the appropriate location and resolder the wire lead connections removed in para.31(4). (Refer to Table 8 of the appendix to this section).

(2) Refit socket A2 to connector 2PL1.

(3) Position the assembly in its location of the rear panel and refit the two special screws and 3 mm crinkle washers to secure the left-hand side of the assembly to the rear panel.

(4) Refit the two cheese head screws and crinkle washers to secure the right-hand side of the assembly to the rear panel.

(5) Refit the two cheese head screws and crinkle washers securing the side screen to the assembly.

(6) Refit screws and crinkle washers to secure large cover and 2PL2 to the assembly.

(7) Align the assembly to the rear panel (para.3).

PA filter sub-assembly

33. To remove the PA filter sub-assembly:

(1) Remove the PA filter assembly from the rear panel (para.31).

(2) Unsolder the coaxial lead at pins 1 and 2 of Unit 2b.

(3) Remove the four outer cheese head screws (without amber rings) and washers which secure the top cover to the assembly casting.

(4) Withdraw the filter sub-assembly.

(5) Remove the cover from the filter sub-assembly by removing the circlip and washer from the shaft and then removing the four screws (amber ringed).

34. To replace the PA filter assembly, reverse the above procedure, threading the two coaxial leads through the holes in the casting before securing the assembly.

Reflectometer

35. Remove the reflectometer as follows:

(1) Remove the PA filter assembly (para.31).

(2) Remove the two pan head screws and nuts securing 2PL1 to the filter assembly.

(3) Unsolder the wire lead to pins 1 and 2 of Unit 2b.

(4) Remove the three cheese head screws and crinkle washers securing Unit 2b to the filter assembly.

(5) Remove Unit 2b and unsolder the external leads.

36. Before replacing Unit 2b, resolder the external wire leads to the unit. (Table 8 of the appendix to this section refers).

Power amplifier panel (Unit 2a)

37. Remove Unit 2a as follows:

(1) Without removing socket A2 from 2PL1, release the PA filter assembly in accordance with the instructions in para.31(1) to (6).

(2) Carefully, so as to avoid damage to the interconnecting leads, lift the PA filter assembly and move it so as to gain access to the PA board terminals.

(3) With reference to Table 8 in the appendix to this section, unsolder the wire leads at terminals 3, 9, 10, 13, 14, 15, 16 on the PA board.

(4) Remove the two screws and washers securing Unit 2a to the rear panel and withdraw the unit, using the cord provided to draw the transistors from the heat sink.

38. Replace Unit 2a as follows:

(1) Cover the transistors and mating surfaces on the heat sink with Grease Dow Corning 340 (Heat sink compound, 100g. 1H 5999-99-224-6475).

(2) Ensure that there is no foreign body on the mating surfaces, then position Unit 2a in its location and secure with the two screws and washers.

(3) Resolder the wire leads disconnected in para.37(3) (refer to Table 8 of the appendix to this section).

(4) Replace the PA filter assembly, para.32(3) to (5).

(5) Position the screen over Unit 2a and secure with the three cheese head screws and crinkle washers.

(6) Secure 2PL2 to the screen with the two pan head screws.

(7) Align the assembly to the rear panel (para.3).

VHF filter (Unit 2h)

39. Remove Unit 2h as follows:

(1) Remove the rear panel assembly from the case (para.3).

(2) Remove the two cheese head screws and crinkle washers securing the side screen to the PA filter assembly and remove the screen.

(3) Using the appropriate extractor tool, detach socket A2, complete with lead, from connector 2PL1.

(4) Unsolder the wire lead from 2SK8.

(5) Remove the two pan head screws and washers securing Unit 2h to the rear panel.

(6) Remove Unit 2h.

40. Replace Unit 2h using the reverse to the above procedure.

Audio decoupler (Unit 2g)

41. Remove Unit 2g as follows:

(1) Remove the rear panel assembly from the case (para.3).

(2) Remove the two cheese head screws and crinkle washers securing the small screen to the rear panel assembly.

(3) Remove the two pan head screws and crinkle washers securing plug 2PL3 to the rear panel assembly.

(4) Remove the small screen.

(5) Remove the nut and crinkle washer securing socket 2SK5 to the rear panel casting. Similarly release 2SK6.

(6) Remove the two pan head screws and crinkle washers securing Unit 2g to the rear panel and withdraw the unit together with 2SK5, 2SK6 and the flexible printed wiring track.

42. Replace Unit 2g using the reverse to the above sequence.

Front panel components

43. When replacing any front panel component, refer to the relevant table of the appendix to this section to ensure correct reconnection of wire leads.

44. Access to the rear of the various components is as follows:

(1) GAIN control, MODE switch and POWER switch - mount Unit 6 in the service position (para.16).

(2) 10 MHz switch - remove the turret (para.11).

(3) Decade switches other than 10 MHz - remove the chassis thus, with Unit 6 in the servicing position, remove the screw and washer securing the turret triangular bracket to the main frame and remove the screws which secure the chassis to the front panel.

(4) Meter - accessible when the front panel and chassis assembly is removed from the case. For removal of the meter, see para.45.

45. After unsoldering the wires to the meter, the special tool provided in the test kit can be used to remove the securing ring at the back of the meter. The meter can then be withdrawn from the front of the panel. When replacing the meter, ensure that it is correctly oriented.

Components mounted in case

46. To replace the whip antenna socket or sealing ring, remove the screening plate, the nuts, solder tag etc at the extreme rear of the socket assembly and remove the socket from the front.

47. To replace the top or base block or their sealing rings, remove the socket as above. Then remove the spring terminal and the two screws that secure the base block to the frame.

Battery spring clips

48. To remove a clip, compress the springs with the tool provided. Then, using a 1/16 in. (1.5 mm) parallel pin punch and proceeding very carefully so as to avoid damaging the casting, remove the two securing pins from the hinge lugs in the casting. Finally, gently tap out the hinge pin and remove the clip.

49. To replace the clip, compress the springs so that the holes in the hinge pins are clearly in line. Replace one retaining pin and insert the hinge pin as far as the first gap. Correctly locate the gap and insert the hinge pin fully. Replace the second retaining pin and remove the spring compression tool.

APPENDIX

TO

DISMANTLING AND ASSEMBLY OF

RECEIVER-TRANSMITTER RT320 SERIES

CABLEFORM CONNECTIONS FOR RT320

1. The following tables list the cableform connections to each unit and are provided to facilitate the fitting (or removal) of various units to (or from) the receiver-transmitter.

2. The wire numbers are represented by the addition of coloured sleeves according to the colour code for resistor values.

Table 1

Cableform connections to Unit 3

Terminal	Wire No.	Unit
1	81	3a
2	76	3a
3	76 (screen)	3a
4	111 (screen)	3a
5	111	3a
6	80 (screen)	3a
7	80	3a
8	83	3a
9	84	3a
10	127 (screen)	3a
11	127	3a
12	110	3a
13	208	3a
14	208 (screen)	3a

Terminal	Wire No.	Unit
2	111	3h
3	111 (screen)	3h
3	98	3h
4	77	3h
5	77 (screen)	3h
6	107	3h
7	108,110 (screens)	3h
8	108,110	3h
9	107 (screen)	3h
2	103	3FU1

Table 2

Cableform connections to Unit 6

Terminal No.	Wire No.	Terminal No.	Wire No.
1	117	27	92
2	68	28	101
4	36	29	91
5	61	31	34
7	37	32	94,95
8	47	33	73,129
10	41,83	34	93
11	38,62	35	90
12	45	36	35
13	84	37	32
14	42	38	79
15	69	39	78
16	65	40	89
17	82	42	87
18	53		(screen)
19	57	43	87
20	80	44	119
21	80	45	119
	(screen)		(screen)
22	76	46	86
23	76	47	71
	(screen)	48	72
24	77	49	51
25	77	50	39
	(screen)	51	43
26	67,128	52	40
	81	53	70

Table 3

Cableform connections to Unit 8

Terminal No.	Wire No.
1	257
3	78
4	87
	(screen)
5	87
7	142
8	256

Table 4

Cableform connections to Unit 1a

Terminal No.	Wire No.
1	32,113, 143
2	93
3	119
4	119 (screen) 209
5	122,144
6	85
7	121
8	103
9	145
10	67
11	138
12	73
13	63,66, 140

Table 5

Cableform connections to Unit 9

Terminal No.	Wire No.	Terminal No.	Wire No.
1	7	23	26
2	88	24	22
3	14	25	23
4	12	26	20
5	16	27	19
6	17	28	18
7	24	29	15
8	21	30	11
9	25	31	13
10	2	32	8
11	1	33	9
12	6	34	108 (screen)
13	85		
14	86	35	108
15	141	36	113
16	146,209	37	10
17	257	38	107
18	256	39	107 (screen)
19	4,88, 122		
21	5		
22	3		

Table 6

Cableform connections to front panel

Terminal No.	Wire No.
1S1A-2	35
-3	36
-4	37
-5	79
-6	41
-7	39
-11	40
-12	38
1S1B-1	88
-6	45
-7	42
-8	43,255
-9	250,255
-10	245,250
-11	245
-12	34
1S1C-1	46
-2	47,246
-3	48
-4	246,247
-5	49
-6	247
-7	50
-8	51
-10	251
-12	46,262
1S1D-1	52
-2	53,248
-3	54
-4	249,248
-5	55
-6	249
-7	56
-8	57,252
-10	252
-12	52,265

Terminal No.	Wire No.
1S2A-1	58
-2	59,240
-4	137
-5	61
-6	62
-8	244
-9	63,243
-10	64
-11	130,243
-12	65
1S2B-2	132
-3	133,253
-4	253
-5	68
-6	240
-8	114
-9	115,241
-10	241,242
-11	242
-12	69
1S5-1	25
-2	31
-3	26
1S6-1	21
-2	22
-3	23
-4	30,31
-5	24

Terminal No.	Wire No.
1S7-1	16
-2	17
-3	18
-4	29,30
-5	19
-6	20
1S8-1	11
-2	12
-3	13
-4	28,29
-5	14
-6	15
1S9-1	7
-2	8
-3	9
-4	28,27
-5	10
GAIN-S	70
-CW	71
-CCW	72
METER -	116
+	117
1S10-1	1
-2	2
-3	3
-4	27,4
-5	5
-6	6

Table 7

Cableform connections - miscellaneous

Terminal No.	Wire No.	Terminal No.	Wire No.
1SK1-3	137	1SK3-1	66
-4	133	-2	89
-5	129	-3	90
-6	130	-4	91
-7	94	-5	92
-8	135	-7	101
-10	124		
-11	125		
-12	128	1PL4-1	140
-14	132	-2	141
-A1	127	-3	142
-A1/0	127 (screen)	-4	143
		-5	144
-A2	126	-6	145
-A2/0	126 (screen)	-9	146
1SK2-1	114	1FL1-1	46
-2	115	-2	52
-3	100		
-5	58		
-10	95	1FL2-1	48
-A1	208	-2	54
-A1/0	208 (screen)		
		1FLB-1	49
		-2	55
		1RL-1	244
		-2	254

Table 8

Unit 2 - wiring

Wire No.	From	To
300	2b-1	PA Filter Sw 3
300 Screen	2b-2	PA Filter Sw 4
301	2a-13	PA Filter SW 1
301 Screen	2a-14	PA Filter SW 2
302	2b-15	2SK8 cup
302 Screen	2b-16	2SK8 tag
303	2h-1	2SK7 cup
303 Screen	2h-2	2SK7 tag
304	2h-3	2PL1-A2 inner
304 Screen	2h-4	2PL1-A2 outer
305	2b-3	2a-3
306	2b-5	2a-16
307	2b-6	2a-15
308	2b-13	2a-9
309	2b-14	2a-10